

SEEN • IN
GERMANY



• BY RAY •
STANNARD
• BAKER •

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Seen in Germany



Seen in Germany

By

Ray Stannard Baker

Author of

“Our New Prosperity,” “The Boy’s Book of Inventions”

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GEORGE FARLAN



New York
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TO
MY FATHER

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I

COMMON THINGS SEEN IN GERMANY

How the German is governed in Small Affairs — The Omniscient Policeman — Bowing — Shops — Beer-drinking — Barnum's Circus — Idea of Americans — Machinery Age

THE American who travels in Germany soon makes the discovery that he has never known what it really means to be governed. He has always felt a calm assurance in the superiority of his system of public administration, and he has paid with liberality for the privilege of having a President, a Governor, a Mayor, and a Ward Boss, yet he has hardly known that he was governed! But there is no such uncertainty here in the Fatherland. For every pfennig that the German pays in taxes, he expects and receives a pfennig's worth of government. He enjoys being looked after, and if he fails to hear the whirring of the wheels of public administration, he feels that something has gone wrong.

From the moment of landing on German soil, the American begins to feel a certain spirit of repression which seems to pervade the land. At first it gives him an uncomfortable impression of being watched; he feels the Wild West in him slowly suffocating: he had not realized before that he was especially wild western. But he soon finds that his attitude of mind is undergoing a change. The brooding spirit of government no longer harasses him, and he finds himself engaged in a humorous quest for what is "verboten."¹ He begins to see the philosophy of all this government; it relieves him of a load of responsibility to have his conduct made clear for him by rules and regulations. He feels grateful to the government that informs him in a plainly printed sign that the water in this trough is for horses, not for men. In America he would be compelled to decide for himself, and he might make the mistake of allowing his horse to drink from a man's trough. When he walks in the park it is a comfort to have the seats labeled clearly, "For Children," "For Nurses with Children Only," and "For Adults Only." Thus the stranger goes through Germany learning rules, and after a time it becomes a passion to trace out all the minute ramifications of administrative supervision. One may travel a long time in Germany and go home with the comfortable feeling that there are still undiscovered

¹ *Verboten*, forbidden.

regulations awaiting another visit. There is one drawback, however, to the full enjoyment of the quest. It may be expressed in a simple rule: Always discover the "verboten" before you are discovered. This rule, if observed, will save the traveler much annoyance. An absent-minded friend of mine crossed a bridge at Stettin on the left side, not knowing that this was one of the "verbotens." He was taken with much solemnity before a magistrate and fined fifty pfennigs (twelve cents). He felt that the experience was cheap at the price. The best way to discover "verbotens" is to ride on a bicycle; they appear painted large at every turn, and if you ride far enough you will conclude that all the especially interesting by-ways are particularly "verboten" and that "verboten" is a kind of profanity used by German policemen.

I never have seen the statute books of Germany, but they must be voluminous beyond comparison, for there is a law regulating almost every conceivable human activity. If a thing is not mentioned in the law books, it is to be presumed that it has no existence. As a consequence, odd things happen in Germany. Early in the year 1900 a company of capitalists began operating automobile 'buses in Berlin, big glittering caravans which tooted up and down the streets like so many steam locomotives, running at a rate of speed much greater than that of the ordinary trams.

Theoretically, the German dislikes being hurried,

but practically and individually he is quite as pleased as the American to save five or ten minutes on the journey to his office in the morning. As a result, the new automobiles did such a flourishing business that the other tram companies, which had long been compelled by stringent laws to limit the speed of their cars, made complaint to the police.

There must have followed a great searching of the statute books. Every sort of vehicle from a wheelbarrow up was mentioned and regulated, but there was not a word about the automobile 'bus. Consequently there was nothing to do but to let it pursue its wild career until such time as a law could be devised and passed. And this, like everything in connection with the government, was a matter of deliberation, so that by the time authority was bestowed upon the police to limit the speed of the new vehicles, the automobile company had cut in on its competitors and had firmly established its position. Exactly the same thing happened when the bicycle was first introduced in Germany. For months bicycle riders rode when and where they pleased, tipped over pedestrians and generally demoralized the police; now they are regulated out of all comfort. There is a great fortune awaiting the Yankee who will introduce flying machines in Germany, and sell out before the machinery of the law overtakes him.

A stranger in Germany soon makes the acquaint-

ance of the police, little as he may desire it. A German socialist once said: "It takes half of all the Germans to control the other half," and one who sees Germany's immense army, her cloud of officials, great and small, and her omniscient policeman, is inclined to believe that the socialist was right. You have been in Germany a week, more or less, when the policeman calls. At first you cannot believe that he is really after you, and then your mind runs back guiltily over your past. He takes out his little book, one of a small library of little books which he carries in his blouse, and inquires your age, your nationality, and how long you intend to stay. You learn subsequently that a record of every person in the empire is carefully kept, with full details as to his occupation, material wealth, and social standing. If you move into a new house, you must notify the police; if you move out, you must notify the police; if you hire a servant girl, you must purchase a yellow blank and report the fact, the girl also making a report. When she leaves, you must send in a green blank stating why she is dismissed, where she is going, and so on. If you fail in any one of these multitudinous requirements of the government, — and I have mentioned only a few of them, — there is a fine to pay, each fine graduated to the enormity of the offence. There are offences graded as low as two cents.

This paternal system of watchfulness and supervision by the police has made every German neighborhood a sort of whispering gallery. Within a few days after you move into new apartments, you find that nearly every one in the block, from the milkman up, knows who you are, what your business is, and how long you expect to remain, and your place in the social scale is fixed once for all with mathematical precision. And directly you begin to pay taxes, for the police have learned, in some mysterious manner, just how much money you have in the bank, and where it comes from; if you are earning a salary they also hear about that, and all these facts speedily reach your neighbors. A New England town with two sewing societies is not to be compared for an instant with a German neighborhood for sociability.

On the other hand, the labeling and cataloguing of the population enables the police to watch the criminal classes and to keep them in subjection to an extent quite astonishing. German cities are safer for strangers, perhaps, than any other in the world. In the same way, close police supervision in the matter of garbage-disposal, street litter, sewage, and so on, has been a factor in giving Germany a well-deserved reputation for clean, healthy cities. I have seen a policeman stop a man, and order him to pick up a bit of paper which he had thrown into the street.



A German Policeman

And there is this comforting thing to be said about the activity of the police. In America the other man is always elbowing you in street cars, crowding in ahead of you at the theatre ticket-window, and in general making city life uncomfortable. But the German has regulated the other man into comparative respectability. For instance, each 'bus and car is plainly labeled on the outside with the number of seats that it contains, and signs on the front and rear platforms show how many persons may find standing room after the seats have all been occupied. And when once the car is filled, not another person is allowed to enter.

You see, also, on the end of each car a little metallic rack with numbered compartments where smokers may leave their cigars as they enter. In the same methodical way the government opera-houses are provided with long passageways in front of the ticket-windows, just wide enough to admit one person, so that in case of a crush to buy tickets there is never any jostling or pushing, and the new-comer must always take his place at the foot of the line.

Another rule in some cities requires an opera-goer who takes a cab to pay the driver his fare in advance, so that there may be no crowding and delays of the cabs at the door of the opera-house. Indeed, the whole cab-service of Germany is regu-

lated in a way to make the American envious of German institutions. In most cities a large proportion of the cabs are provided with "taximeters" — little dials placed in front of the seat and so arranged that they indicate just how much the passenger owes at any given time. For instance, when you take a cab in Berlin the indicator shows a charge of fifty pfennigs (twelve cents) as soon as you take your seat, and as you drive the figures change, ten pfennigs at a time, and when you are ready to stop you pay the sum indicated by the dial, no more, no less. Thus there is no chance for extortion on the part of the cabman, and no disagreement as to charges, a feature of disagreeable prominence in London and Paris. And it may be said in passing, that the charges are generally very low compared with those in American cities.

Indeed, there are not many things in Germany that the government does not own or control, or at least influence. When you travel, you must buy your ticket of the government, for the government owns all the railroad lines, you eat government sandwiches at the station, you send a telegram over government wires. Your letters, of course, go by government post, but so do your express packages, and it may be said for the Germans that their conveniences for sending packages and money by mail are much nearer perfect than ours. In America,

the influence of those mighty corporations, the express companies, has prevented the development in the highest degree of our postal system. In Germany, one may send a package of almost any size by mail at rates astonishingly low compared with those of our express service. Packages may also be ordered and sent C. O. D. by mail, for a small fee, the postman collecting the money from the purchaser and returning it to the seller, — a system which greatly facilitates business in the empire by doing away with much letter-writing, and the expense of mailing bills and checks. In the same way the Germans have perfected an unequalled system for the quick delivery of messages in large cities. In Berlin, one may purchase what is known as a rohr-postcard for twenty-five pfennigs (six cents), write a message containing as many words as the card will hold, and it will be specially delivered almost anywhere in the city within an hour. It is better by far and cheaper than the telephone, for only comparatively few people have telephones; it is quicker and much less expensive than the telegraph. Indeed, there is probably no system in operation in the world which is at once so universally of service to rich and poor, so prompt and so cheap. It is much used for making all sorts of appointments and in all manner of business transactions. There is a great opportunity, certainly,

for such a convenience in American cities; but the power and influence of our great telegraph and telephone corporations will probably prevent its



Children's Sand Pile in Dresden, supported by the City

introduction for a long time to come. It may be said in passing, also, that ordinary postal cards may be sent in German cities for two pfennigs — less than half a cent.

In Germany, the government owns the greatest

opera-houses, and if you would hear the best music, you must listen to musicians who are paid from the public treasury. A government minister preaches in the government-owned church that you attend on Sunday, and if you are a student in a university, the professor who lectures to you is a government official. Sometimes you can even trace the government inspector's stamp on the chop served at your restaurant. And you are not at all surprised to see children playing in municipal sandpiles in the parks of Dresden. Then there are the cherries, — the big luscious red cherries which come when you order a *compot* with your meat. These, you hear, are called Reichskirschen, "Imperial Cherries," and you learn that the government has embarked, with rare frugality, in the business of fruit-raising. Along each side of the government railroad tracks there is a strip of land which is utilized in places by planting with rows of cherry-trees. These are cultivated with care, and no improper little German boys ever climb up and steal the fruit. In the summer the empire or the kingdom gathers its cherry crop, and takes it to market, and later the imperial cherries appear as a *compot* to delight the German palate, and suggest the all-sufficiency of the governmental machinery. The profits are credited in the state revenues. I did hear that an account was kept with each separate cherry-tree, but one is not com-

pelled to believe all he hears, even though it be characteristic.

All government in Germany smacks strongly of the military camp. Many of the officials, especially those of the lower grades, — such as policemen, firemen, and so on, — are old soldiers who have won their places in civil life by years of faithful service as noncommissioned officers in the army. They have all the methodical habits of the barracks, and very naturally they look upon the public as a great awkward squad to be cajoled into subjection and proper discipline. The awkward squad in this case submits the more easily because every man in Germany has served his time in the army, and knows how to put up with the exactions of noncommissioned martinets. Indeed, the exactness and order, the minuteness of regulation, and the infinite detail of military life pervades the entire social fabric of Germany. Everything, from beer-drinking up, goes by rule, and most of these rules have been set forth in books or pamphlets with the characteristic thoroughness of the Teuton.

I shall not soon forget the dazzling effect presented by a fine-looking, soldierly German whom I saw coming down Unter den Linden at noonday in a full dress suit, a tall hat, and white kid gloves. No one seemed at all surprised at his appearance, and I learned afterward that he was probably some new government official going to pay his respects to his chief,

and that every detail of his costume was prescribed in the written order that summoned him. A foreigner in Germany is certain to make the most amusing mistakes in the matter of formality and informality of dress. It may be said in passing that a German set dinner is a horror of formality, but it is quite worth while, for the excellence of the French cooking. On the other hand, a German beer-dinner is the acme of sociability and kindliness, a kind of easy familiarity and simple enjoyment, by the side of which almost any English or American dinner is icy with dignity. For the Germans know how to enjoy their food and drink.

An English lady, the wife of a famous scientist, gave me an amusing account of her experience at a reception given by the wife of a German professor. As soon as she came into the room, she was invited to a place on a huge, soft sofa standing in a prominent place at one side of the room. She much preferred a chair, not only because it would be less conspicuous, but much more comfortable. But when she would have taken an empty chair, to her astonishment it was promptly removed and occupied by one of the German women, and she was finally compelled to take a seat on the sofa. Presently another English lady of rank appeared, and the wife of the scientist was promptly invited to leave the sofa and take a chair, and the new-comer, by hook and crook, was induced to occupy the sofa.

Afterward all these proceedings were made plain: the sofa was the place of honor beyond all others, and it must be occupied by the most important lady present, whether she liked it or not.

Then there is the fine art of bowing. In Germany, you lift your hat to men as well as to women. If you meet General Schmoller, you raise your hat high and bring it down to your knees with a full sweep of the arm; if you meet Herr Schmidt, who is your social equal, you tip your hat as much as he does his—and no more; whereas, if you meet your tailor you respond to his low bow by the merest touch of recognition. To the initiated every man proclaims his social position at every step, by his bowing. One must remove his hat when he enters a store, though, strangely enough, the same man who stands uncovered while he is purchasing a pair of gloves will wear his hat in the café next door. The Englishman, whose neck is proverbially stiff in the matter of bowing, always leaves behind him the smoke of offense when he leaves a German shop, for he has invariably forgotten to remove his hat. The German store-keeper is the soul of politeness. He rushes out to open the door for you when you leave, and whether you have bought anything or not, he has an appreciative “thank you” ready for you. Indeed, the spirit of thanks is one of the pleasant things that the stranger encounters in Germany. The elevator boy who takes you up to

your room thanks you heartily when you become his guest, the waiter thanks you when he takes your order, the barber thanks you when you sit down in his chair. And I am sure that this is not done merely with a view to ultimate tips, for many Germans tip very sparingly ; it seems to me that it proceeds rather from a very genuine friendliness which I have seen manifested in so many other pleasant ways in Germany. At least, I like to think so.

Speaking of the shops of Germany, nothing could be finer than the window-displays of the book, art, and flower stores ; they are fine, even after Paris, especially in Munich and Dresden, and they are brilliant compared with the ugly displays in London. One walking up a city street in Berlin for the first time is irresistibly attracted by the splendid window-shows, not only of books and works of art, but of all sorts of other things, and by and by he is so far tempted that he enters the shop. And what a disappointment ! From the appearance of the window, he has anticipated greater glories within ; but here is a stuffy, dim little shop, ill-arranged, over-crowded, and often dusty. And like as not he finds that a greater part of the merchant's stock is in the window, a part of that magnificent display, and that when he asks to see a piece of goods, the clerk must go crawling into the window after it. Of course there are fine shops in Germany, but they are not plentiful.



Outdoor Drinking Resort for German Students

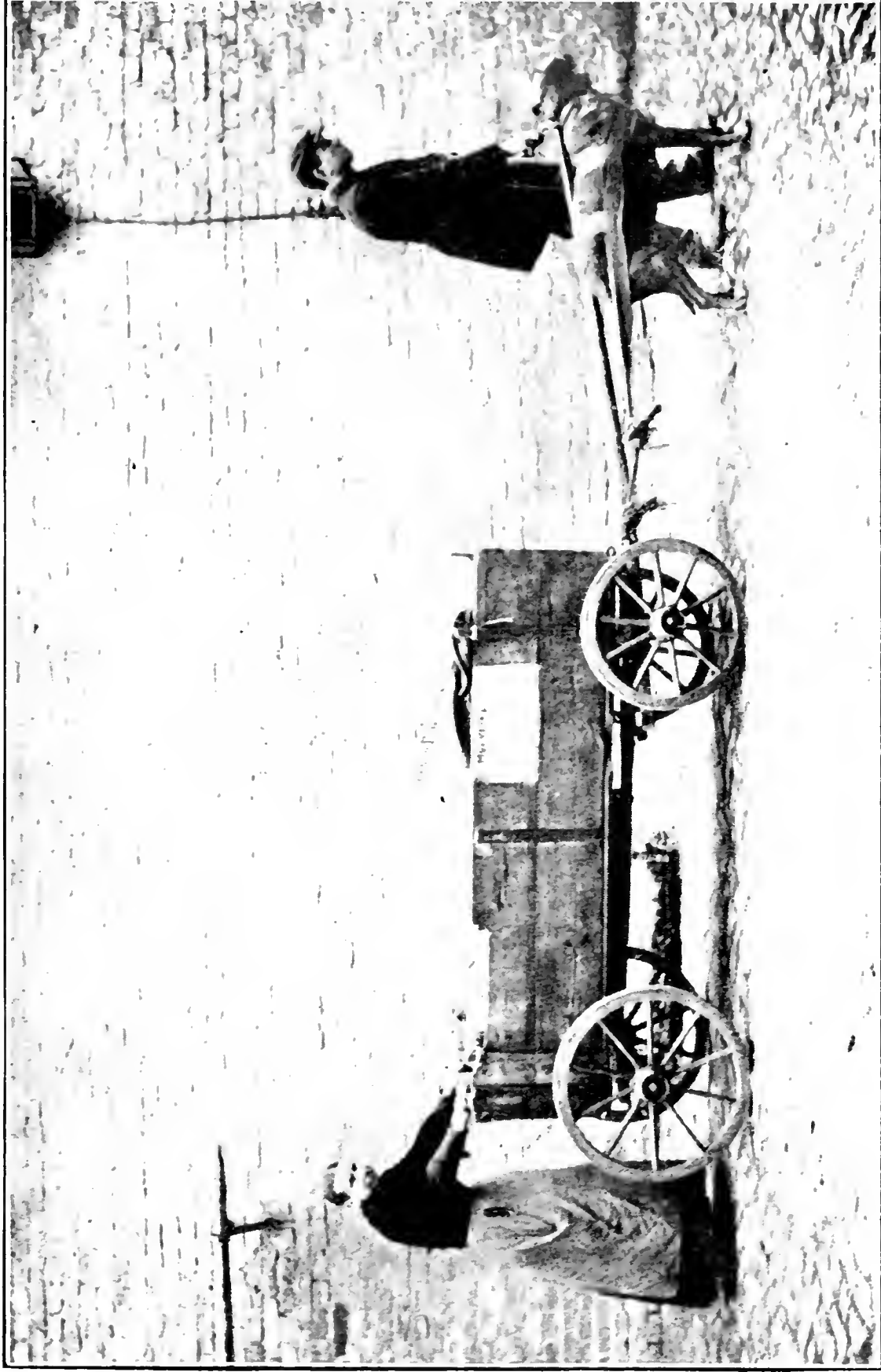
One day in a German book-store I picked up a book of rules for drinking beer ; it was a good thick book, and it must have required not a little study to master it. Afterwards I found how thoroughly some of these rules were observed. There are regular formulæ of words to be followed, all set down in clear type, so that even a wayfarer, though a fool, may properly express his sentiments to his beer-drinking companions. When you wish to drink with a friend you say, "prosit," and you look him in the eye. If he feels thirsty, he says, "I come immediately ;" if he wishes to delay the response, he says, "I come soon," but he must not forget you ; when next he drinks, you are the friend with whom he "comes." And sometimes the German rises to propose the company, and he says, "I drink my bloom," whereupon the entire company drinks the bloom ; or if he be exceedingly thirsty, he says, "I drink my bloom, and that which hangs thereto" — and he empties his glass. There may be small men in the party to whom "that which hangs thereto" may be more than sufficient, but if they wish to be strictly polite they must not leave a drop. These are only a few among hundreds of rules, observed most rigidly among the students and in the drinking clubs.

One evening I walked out to a little tavern among the Thuringian hills, one of those quiet places at the end of a beautiful stroll which the German loves. It

was a curious old place, smoky-raftered and hung with prints half a century old. The long tables were filled with men and women and a sprinkling of children, and the beer flowed free. Along in the evening a white-bearded old man came around and distributed a leaflet on which was printed a German song. After every one was supplied, the old man struck a gong, and at once the whole party began to sing with right good-will, — joyously and unaffectedly. There were, as I knew, solid German citizens and business men in the company, as well as students and workmen with their wives; for a German beer resort is nothing if not democratic. All these sang together and enjoyed it well, stopping at places indicated in the song by the words, “beer-pause,” and after a long look into the tall wooden mugs, they sang again. It was really delightful enough in its entire simplicity and complete sociability, but the sentiment of the songs — and there were many of them — was amusing enough to a stranger. They were not singing love ditties or national hymns, nor yet music-hall ballads. Each song was the work of a local poet, and it expressed in highflown language the glories of this particular beer-place, — how good the beer was, how jolly and benevolent and honest the host was, what a splendid view there was from the windows, how sweet the barmaid looked, and such sausages as she served! And

business men and all, they sang the glories of the place for an hour or more, and then they walked home in the cool of the evening, sober but sociable. One could not help thinking how shy an American or an English gathering would have been in expressing such warm sentiments for a host; they would have felt that they were being used for advertising purposes; and there is nothing that sooner stings the dignity of your American.

The German has not reached the point of revolt against advertising. Like everything else, advertising is limited by law; the cities provide certain large wooden columns at street intersections upon which placards may be pasted, and the streets are not disfigured by dead-walls bearing patent-medicine advertisements. One coming into New York or any other American city must perforce be impressed with the virtues of somebody's soap or pain-killer painted in letters that seem to fill the landscape, and in London the trams and 'buses are one mass of traveling advertisements. This disfigurement is unknown in Germany, and yet the Germans have their own effective methods of proclaiming the excellence of their wares. Look at the gimcrack toy which your boy is playing with, and you will find upon it the words, "Made in Germany," and if you travel in Germany you will find that you are very persistently plied with circulars and pamphlets by post and otherwise. Last summer



Woman and Dog as Beasts of Burden, a Familiar German Sight

Barnum's circus visited Germany for the first time, and brought with it American methods of advertising. I am not exaggerating when I say that Barnum paralyzed the Germans, — both paralyzed and scandalized them. They didn't think it possible for any business enterprise to make so much noise; it was positively undignified. For Barnum bought up store-windows and store-fronts by the hundreds, and his enormous colored prints, such as had never before been seen in Germany, told the wonders of the show to gaping multitudes. They disapproved of all this, but they went to the show. I heard complaints afterwards that the circus was too big; they felt that they were losing money when there were performances in three rings, and they could see only one at a time.

The Germans, as a rule, disapprove of all foreigners, especially the English and French, and during our Spanish war they hated us most ardently. I don't know that the Germans are peculiar in this respect; every country thinks best of its own. But the individual German ordinarily treats a stranger with the greatest kindness and hospitality. I have had a hundred examples of this. Curiously enough, the ordinary German — I do not refer to the educated classes — cannot tell foreigners apart, not even a Frenchman from an Englishman, except, of course, those Germans who live on the French border.

The reason for this is simple. Unlike New York, for instance, where all the races of the earth dwell together in unity, Berlin, and most other German cities, are most uncosmopolitan. The proportion of foreign residents is exceedingly small, so that the Germans have had little experience in distinguishing nationalities. Recently, however, Italians have appeared in Germany, to do such hard manual labor as they do in New York.

The German experiences especial difficulty in distinguishing Americans from Englishmen. Several times during the Boer war, when the anti-British feeling was strongest, street boys called after us, "English, English, poison-throwers," — no doubt referring to the throwing of lyddite shells by the British forces in South Africa.

But I heard of one German who knew an American every time he saw him. He was a professor of ethnology, — a gentle, absent-minded old man who wore thick prism glasses that made his eyes stare out blue and big, giving him a look of perpetual astonishment. He had made a study of the craniums of his American students, and it was amusing enough to find that he looked upon Americans as a class, as incipient red Indians. He had formed the curious theory that all Americans, owing to the nature of their climate, and other conditions of environment, were gradually acquiring the characteristics of the

Indian aborigines, — high cheek-bones, straight, coarse hair, and a bronze-colored complexion. I learned that he sometimes stopped Americans on the streets and requested the privilege of examining their cheek-bones, always with a look of humorous astonishment. I suppose that in time we shall have a voluminous and learned monograph on the subject, done as only a German professor can do it.

The ordinary German has a rather hazy idea of America and Americans, although it is perhaps as clear as the ordinary English idea. He knows Milwaukee, for he has a cousin there; he knows Hoboken, for that is where the German ships land; and he has heard of Niagara Falls and Chicago. The only Americans I ever heard mentioned, not of course among the educated people, who are tolerably familiar with things American, were Carl Schurz, Dewey, and McKinley. The Spanish-American war did more than anything else has ever done to educate Europe on American affairs. Previous to 1898, they heard of our lynchings, train-robberies, political dishonesty, and international marriages, which confirmed them in the view that we were vulgar, energetic, and rich; but now the papers contain a good deal of American news. All Americans, it may be said in passing, are still regarded as rich.

An English-speaking stranger in Germany is astonished by the wide knowledge of his language, and

not only among hotel porters, waiters, and others who have special need to cater to the tourist element, but among business men who seldom meet tourists, shopkeepers, barbers, and, of course, professors, military officers, and so on. An ordinary tourist who wishes merely to see the country, has little need of knowledge of the German language. English is the greatest of commercial languages, with a world-wide use, and it is quite necessary to business enterprise, especially in foreign countries, for the German to be able to speak English fluently. As a result, thousands of young Germans go to Great Britain every year and serve an apprenticeship in English business-houses, barber-shops, restaurants, hotels, and the like, gaining a knowledge of the language and of the weights and measures, and at the same time studying business methods generally. Indeed, England has unintentionally given much of the instruction that has enabled the German to win some of his greatest business triumphs of recent years, so that the pupil now threatens the commercial supremacy of the master. During this preliminary service in England, the German is willing to work for little or nothing, considering his occupation in the light of an educational course. Thus London is brimful of Germans, — barber-shops with only an English-speaking proprietor, restaurants that swarm with German waiters, and shops that employ German workmen. Of late

years many German boys go to Ireland to learn the language, and acquire at the same time the Irish middle-class opinion of England, which they cherish and propagate on their return to their native land. Perhaps that is one of the sources of German dislike for the Englishman. Another thing that the German boy acquires in Ireland is a rich and varied brogue, and one of the most amusing things one hears in Germany is the waiter who speaks German-Irish-English. A music-hall comedian who could adequately imitate this combination as I have frequently heard it, would certainly make his fortune. Next to this in ludicrousness is the Cockney English of many porters and waiters, learned, I have no doubt, within the sound of Bow Bells. Much of the language acquirements of the waiter-class is, however, barely skin deep. Talk about food, forks, and fees, and the waiter understands instantly; but ask him a question outside of the realm of the dining-room, and he is lost, and so are you. Some Germans of the better class come to America to learn the language; but this, as I understand, is looked upon with disfavor, for many of those who come never return, finding undreamed-of business chances here, to say nothing of plenty of German society. I met a young German, the son of a general in the imperial army, who was, moreover, a "von." He had been in New York for nearly

two years, he spoke English fluently, and he was returning to do his final service of four weeks in the army. A military career in Germany was open to



A German Double-Deck Tram-Car

him, and it had been his intention in America merely to learn the language; but he liked American life so well that he had decided to return and make his home in New York.

A hundred and one small things point significantly

to the recent remarkable developments in Germany, and they are quite as convincing as the difficult government statistics of industrial progress, exports, and growth of population. In no fewer than three hotels at which I stopped, I was lighted to bed with an old-fashioned candle in a quaint brass candlestick, and in each case the porter apologized, and explained that they were just then fitting the building with electricity, and that in another month or more every room would have its own incandescent lamps. We in America have been content to take our progress more slowly. From the candle-stage we rose to the kerosene-oil lamp, and from that we drifted to the gaslight-stage, and that in turn was superseded by electricity. But the German has made a swift leap from dim candlehood to the blaze of electric-light-hood, —and not only in hotels, but in private houses and business buildings. In the same way, the transit system of many German cities has been suddenly transformed from crude lumbering 'buses drawn by horses, to the most approved electric cars and automobiles, skipping entirely the intermediary stages of horse cars, cable cars, and often passing even the trolley stage, and springing at once to the underground wire or storage system. When the German made up his mind to advance, he advanced all the way ; he took no half measures. An American engineer who was visiting Germany after an

absence of three years, told me that the great cities, especially Hamburg, Berlin, Nuremberg, and a few others, actually seemed made over in the short time since his last visit.

“Lightning has literally struck Germany,” he said, and he pointed out how the cities blazed with electricity, — streets, show-windows, hotels, restaurants, and private dwellings. Berlin is brilliant compared with London. Indeed, no country in the world, not even the United States, is advancing more rapidly in electrical development than Germany.

Then there is the matter of the development of the mechanical sense among the people at large. I sometimes think that we Americans are becoming a race of mechanics ; we are surrounded by machines of more or less intricate mechanism, and we learn to operate them, take them apart and repair them. The principles of machinery are coming to us with our grammar and geography. We have bicycles, sewing-machines, phonographs ; we play on pianos by machinery ; our farmers are literally surrounded by machines ; we talk by telephone and use call bells ; we speak of currents and cut-offs, dynamos and batteries, with easy familiarity ; we ride in machines and we write with machines. And Germany seems to be following in the same direction. Nearly every town of any consequence in Germany has one or more agencies for American sewing-machines and

for the American kodak. Bicycles and tricycles are everywhere, and motor-carriages can be seen in the streets of most of the cities. All large new buildings are being fitted with elevators and call-bell systems, though in most cases the elevators are very tame affairs in the matter of speed. Indeed, so new is the elevator that there exists a humorous confusion of names. In some places it goes by the English name "lift;" in some, by the American name "elevator;" in others, by the French term; while the patriotic Germans call it in some instances, "fahrstuhl," and in others, "aufzug." The slot machine has also had a remarkable development in Germany. At many railway stations, if one wishes to go out on the platform to meet a friend, he must perforce drop a tenpfennig piece (two and a half cents) in a slot machine and draw a ticket. He may buy unlimited postal cards, candy, and gimcracks at slot-machines; he may drop the equivalent of a penny in the slot and hear phonographic music, or see moving pictures. But the most notable development of all is the automatic restaurant. There are several of these curious institutions in Berlin, two very fine ones in Friedrich Strasse, and they are also to be found in other German cities. They are large, brilliantly fitted rooms, with metal and glass walls which contain a great number of pockets and slots. Supposing you wish a glass of beer and a sandwich, you drop

your twenty-pfennig piece in the proper beer-place, and having set a glass underneath a spout, you turn a handle and immediately your glass is foaming full. Then you cross the room to the sandwich department, where, through a glass wall, you may see all the varieties of sandwiches in stock. When you have selected the kind you wish, a coin in the slot will cause it to drop out on a little shelf, and thence to a plate or into your hand. Should you desire coffee, milk, salad, cold meat, preserves, and in some cases warm dishes, they are all to be had for the dropping of a coin, and the food furnished is well cooked and fresh. Tables are provided at which one may stand or sit and eat his lunch. One would think that such institutions would in nowise attract the leisurely German, who loves to sit long over his beer and sausages; but they are quite as popular as our own quick-lunch restaurants, being especially crowded in the evenings.

There are many other evidences that the German is deep in the dust and grime of the machinery age. In more than one great manufacturing establishment hundreds of labor-saving machines of American make are to-day in operation, whole plants, indeed, being fitted with them throughout.

I had the pleasure while in Berlin of visiting the factory where the Mauser rifle, the best known of military small arms, is made. It is a huge plant,

fitted with hundreds of lathes, boring machines, screw-making machines, and so on, and what was my astonishment to see on nearly all of the machines the name of a well-known Connecticut manufacturer. These Connecticut machines made the rifles with which the Spaniards shot our soldiers at San Juan and El Caney. Indeed a great manufacturing establishment in Berlin is engaged solely in the manufacture of machinery of various sorts from American models. In science we have learned much from the Germans; in machinery the Germans are learning much from us. And this introduction of labor-saving devices is going on all over the empire to a degree that can hardly be realized by a foreigner; it is one of the causes of the greatly increased output of German factories.

II

THE KAISER

II

THE KAISER

His Personality and his Passions

THE American visitor who sees William II. of Germany for the first time is curiously impressed with the influence of the comic paper. He discovers that his imagination in picturing the Kaiser has followed the exaggerations of the caricaturist rather than the sober reality of the photograph. For the German Kaiser is not at all what his caricaturists, at least his foreign caricaturists, make him. In the first place, he is not a large man, neither tall, nor inordinately broad of shoulders. Somehow it is the natural bent of the human mind to associate majesty with physical bigness. I believe the old Egyptians represented their Ptolemys and Rameses as giants. And William, who knows the psychology of royalty to the seventh shading, has built high on this feeling. Any one of the seventy-eight court photographers, more or less, in Berlin, will tell you how carefully William always arranges the groupings when he is

to have his picture taken in company with others; and a study of the resulting photographs will show how, almost invariably, William looms tall above the shorter men who surround him. A favorite picture represents the Kaiser standing side by side with the famous artist, Menzel, whose four feet, something, of stature gives William the frame of a Goth. In one of the galleries there is a portrait of the Kaiser in full naval uniform, standing on the bridge of one of his ships of war. The canvas, which is so hung as to strike the visitor as he enters the doorway, is of enormous size and the figure of the emperor stands out of it with gigantic impressiveness. Even in many of his smaller pictures, the cabinet photographs, the camera has been moved so close that the Kaiser's face nearly fills the plate, thereby giving an extraordinary impression of hugeness. The caricaturists have naturally exaggerated the suggestions given by these various portraits, and it is with something of a shock that one realizes, for the first time, that the Kaiser is, after all, only a man of common stature, or less.

In other ways, also, a first view of the Kaiser impresses one. A photograph gives no hint of color. The Kaiser is a brown-faced man, the brown of wind and weather, of fierce riding on land and of a glaring sun on the sea. His face is thinner than



The German Kaiser

one has pictured and there is a hint of weariness about the eyes. His hair gives the impression of being thin, and his famous moustache is not so long nor so jauntily fierce as one has imagined. There is many a dry-goods clerk in Berlin who has out-Kaisered the Kaiser in growing a moustache.

But, owing to the sin of retouching, there is one thing that few of William's photographs show to advantage, and it is the most impressive characteristic of his face. And that is its singular sternness in repose. Square, iron jaws, thin, firm lips, a certain sharpness and leanness of visage, a penetrating eye, all speak of invincible determination, pride, dignity. Indeed, herein lies the force of personal majesty, for William, however much one may smile at his passion for royal display, has many of those splendid attributes of character which would make a man great in any sphere of life. It would be a large company of Germans, indeed, among whom one would fail to select him instinctively as the leader. A first impression, therefore, may thus be summed up: The Kaiser is less a great king than one has imagined, and more a great man. The longer one remains in Germany, and the more he learns of William and his extraordinary activities, the deeper grows this impression. We Americans have never quite overcome our first prejudices against the Kaiser, bred during the early days of his reign, when the

mantle of royalty — and the Hohenzollern mantle at that — was new to his shoulders, and he said and did strange things; but in Europe, where they have grown accustomed to his vagaries, now, indeed, much less pronounced in their manifestations, and have set them down as the expressions of a strong and original individuality, the Kaiser occupies a place of high and genuine esteem. An American who remains long in Germany feels this change in sentiment strongly and when the Kaiser passes he raises his hat with all the others, not merely because this is royalty, but because it is character and strength of purpose.

As might be expected, the Kaiser is most popular in his capital. One hearing a commotion on Unter den Linden, with a flash of white plumes in the distance, and the swift clatter of hoofs, may well crowd up to see. A pair of splendid horses, traveling like the wind, two richly uniformed men on the box, and the Kaiser, the Kaiserin, and another lady in the open carriage behind. You observe that the Kaiser sits with his back to the horses, giving the place of honor to his wife, for William has set the highest ideals in courtesy to women — the Anglo-Saxon ideals, which often form a strong contrast to the rougher Teutonic customs. He wears a glistening silver helmet, which he touches with military precision as the people on the streets shout and lift their hats.

No cavalcade of guards accompanies the carriage, and there is apparently no effort to guard the lives of its occupants, except in so far as they are protected by the terrific speed at which the horses are always driven. It is one of William's pleasures to show himself and his family frequently to his people and the royal carriage may be seen at all hours in the streets of Berlin. The Kaiser's departure from the palace is always signalled by the fall of a flag, which serves as a notification to the people to prepare for his appearance among them. Nearly every afternoon he rides out, usually in uniform, with some of his staff officers, galloping down the Linden and into the Thiergarten, where he often spends an hour in exercise.

The Kaiser appears to better advantage on horseback than when standing, being tall of body. He has a great variety of uniforms and one may see him many times and never see him clothed twice alike. This diversity of dress is one manifestation of his well-known love of display and pageantry. He loves the outward manifestation of royalty, the symbols of power, and he uses them without stint. Not long ago an American professor attended a reception in the royal palace given by the Kaiser to an association of scientists, at which William appeared in the gorgeous robes of royalty preceded by liveried chamberlains bearing the crown and insignia. It was a

most impressive display, and when the professor came away he said to a friend :

“ I am a republican to the backbone, but I believe that if monarchs are necessary they should be monarchs to the last bit of gold lace, just as William is Kaiser.”

The next day this friend had an audience with the Kaiser, and in the course of the conversation told him what the American professor had said. The Kaiser laughed heartily.

“ That is exactly what I believe,” he said. “ Dom Pedro of Brazil illustrated the folly of trying to be a republican on a throne.”

The pictures of the Kaiser and his family form an admirable indication of the degree of his popularity in various parts of the empire. It is said that the different photographs of the Kaiser now number far into the thousands. At a single shop which I visited in Berlin, there were no fewer than two hundred and sixty-seven different pictures of the Kaiser and this did not include the scores upon scores of groups and family pictures in which the Kaiser appears. It is said that the Kaiser averages a picture a day, year in and year out. Of course weeks will pass when no photograph is taken, at least no official photograph, and then there comes a time when a dozen of them are made in an afternoon. In Berlin, one cannot possibly escape the Kaiser's face : it is everywhere, in the hotel room where you sleep, in the restaurant



The Kaiser and Kaiserin

where you eat, in almost every shop window, in the picture galleries, in the churches, in the public buildings, and in every illustrated paper. No American presidential candidate ever had his likeness so widely displayed even at his home town in campaign time. And not only photographs, but paintings, busts in marble, bronze, and bisque, cheap colored prints, medals, bas-reliefs, and every other known form of representation of the human face.

This is in Berlin, the centre of Prussian loyalty. In the northern provinces of Germany, especially in Pomerania, the pictures of the Kaiser are not so plentiful, and yet they are very numerous. One may see thousands of them in Stettin, where there are tens in Dresden. Indeed, as one goes south from Berlin the Kaiser's pictures grow fewer in number, until at Munich one rarely sees any of them displayed, — certainly the best evidence of the aloofness of the Bavarians. Judged by the number of his pictures on view, the Kaiser is more popular to-day in Cologne and Aix-la-Chapelle, in the half-French Rhine country, than he is in Bavaria. Indeed, one who hears everything in the Kaiser's praise in north Germany will get a glimpse of the reverse opinion in south Germany. In many places, like such crowded manufacturing cities as Chemnitz, one hears much said against the Kaiser, although it is not so much against William as it is against the form of government which

he represents. And if William fears anything in the world it is the spirit of socialism which grows rank in these factory towns : in more than one of his speeches he has mentioned socialism as one of the things which Germans must conquer with a strong hand.

The greatest criticism of the Kaiser made by his people is that he talks too much. One hears that everywhere. I think the Germans rather admire William for thinking as he does but they blame him for saying aloud all he thinks. That is characteristic of the German ; he is born a free thinker, but his institutions and the watchful eye of the omniscient police forever keep the lid shut down upon his genuine sentiments ; he is slow of anger and unrivaled in his reverence for authority. It so happens, therefore, that while the Kaiser may often be expressing the real sentiment of his people he is expressing it too loudly to suit the cautious German type of diplomacy. Another criticism, which is not now heard as frequently, perhaps, as it was a few years ago, condemns what the Germans imagine to be a pro-English attitude on the part of the Kaiser. They cannot forget that their sovereign is by birth half an Englishman ; and many there are who look with only half-concealed suspicion on the cordial relations that existed for so many years between the Kaiser and his grandmother, the late Queen, and suspect his present friendship with his uncle, King Edward VII. It was once said that the



The German Crown Prince

Kaiser was more sensitive to this criticism than to almost any other, and the story of his famous reply when injured at a regatta some years ago is still told in Germany. As he saw the blood flowing he said grimly: "Well, there goes the last drop of my English blood."

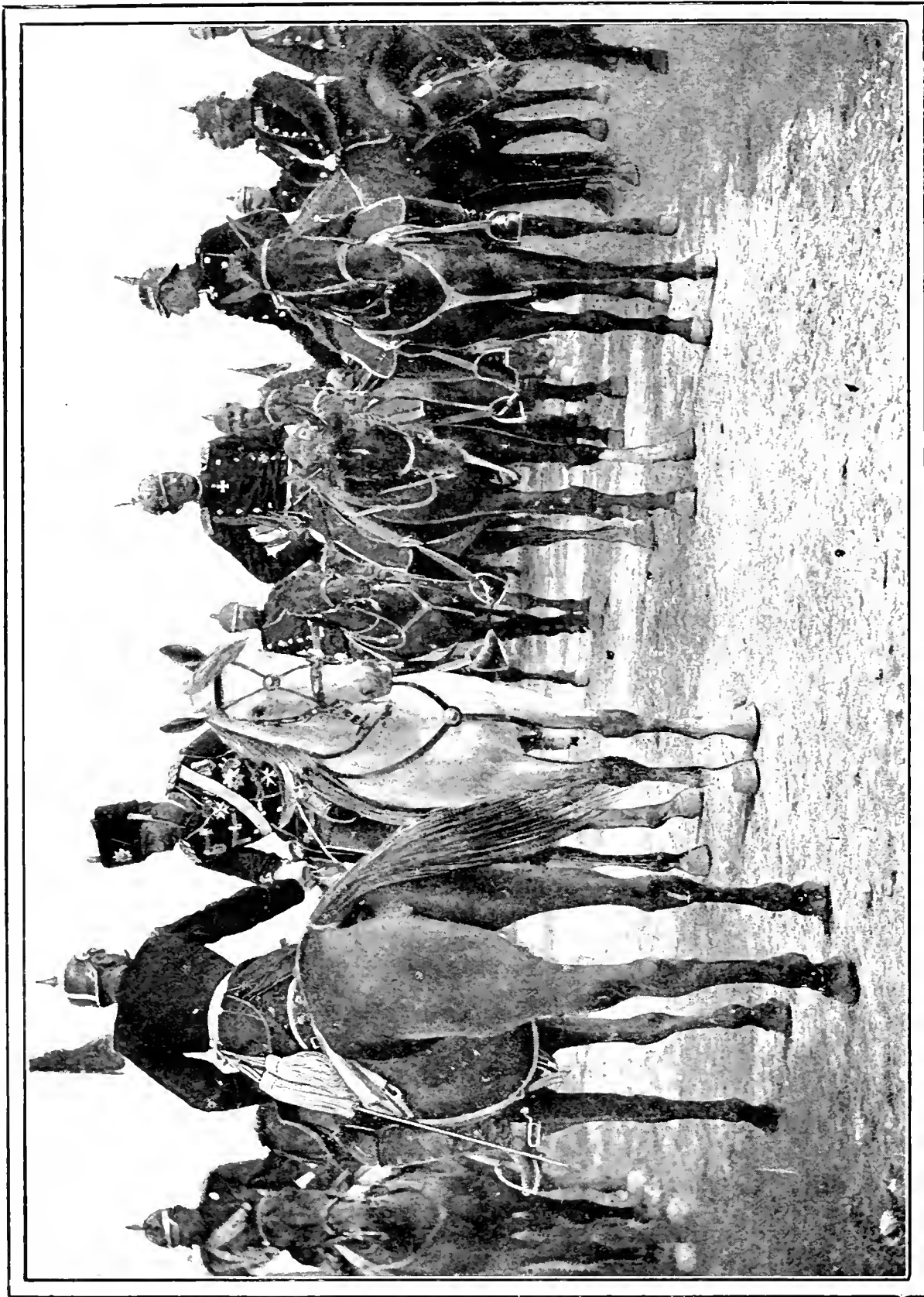
In the light of this sentiment one wonders how the average German regards the recent display of friendliness between the Kaiser and the King, during the funeral ceremonies of the Queen, as well as the apparent agreement regarding the Chinese question.

The Kaiser is an excellent English student, speaking and reading the language perfectly and following English models in many of his most important departures. One does not forget that the Kaiser as a boy was especially fond of Captain Marryat's tales of the sea, and that in more recent years he was one of the most enthusiastic admirers of our own Captain Mahan's great book, "The Influence of Sea Power," — a book which he has used as one of his strongest arguments for a more powerful German navy.

The Kaiser is much too great a man and the claims of his country are too insistent, to permit him to specialize in any great degree in his interests, and yet he is but a man and certain lines of activity engross his attention more than others. Upon his accession to the throne his enthusiasms were chiefly military; he loved his army and he longed passionately to use it. This interest still continues to a degree, and yet

it may be said that at present the Kaiser's greatest hobby is his new navy. He has enough English blood in him to make him passionately fond of the sea and of sea life, and his leanings toward all that is martial make him the natural sponsor of a great navy.

And it has required all the determination, tact, and enthusiasm of William the man, as well as all the immense power of William the Kaiser, to convince the Germans that a great navy is a necessity to the nation and then to persuade them to pay for it. If William were an American he would be classed in politics as a republican with strong sentiments of imperialism and expansion, a supporter of the doctrine of high protective tariffs and sound money, and a steady champion of a larger army and navy. His enemies might even accuse him of a fondness for trusts. He has been compared in character and aims to Theodore Roosevelt, and the similarity of the two men in restless energy, honesty, wide general culture, and information and admiration of things martial, is certainly most striking. Years ago the Kaiser began studying the naval question in every one of its phases, and thus he continued until he was intimately familiar with the navies of the world as well as with the naval attitude of each nation. Indeed, he is said to know by name the chief war vessels of every country with the tonnage, armament, and equipment of each. With this knowledge in hand he began a mighty



The Kaiser among his Officers

campaign of education among his people. He invited members of the Reichstag repeatedly to the palace, showed them lantern pictures of the great vessels of the world, and gave them lectures on naval affairs, and the moral that he invariably preached was: "Germany must have a great navy." He argued from the point of view of commerce, of industry, of expansion, of sentiment and patriotism, and he finally succeeded in getting nearly all he wanted, only to find that he wanted more; and so the work is still going forward.

War anywhere in the world mounts like strong wine to William's head. He hears afar the sounds of strife, and he longs to be there to see. And sometimes he grows so excited that, like a small boy at a fire, he can't help shouting, and then the world wonders over his curious cablegrams of sympathy or encouragement. There was no more fascinated observer of our war with Spain than William of Germany; he watched every phase, he studied every maneuver, and later he used this information well in persuading his obdurate legislators that Germany must at least have a navy equal to that of the United States.

More recently he has been interested in submarine boats, and when the English pounded the old "Belle Isle" to pieces he was one of the most eager of inquirers as to the exact effect of the shells on the sides of the old hulk and in her hold. Indeed, as soon as the bare report of the tests had been tele-

graphed to Berlin, William was discussing them eagerly with the foreign military attachés. He is, by the way, a great favorite with the foreign attachés. He treats them with bluff bonhomie, entertains them frequently, pumps them dry, and sends them away in all their lean emptiness, feeling that William is the greatest man on earth. At his palace at Potsdam, he has many conspicuous naval ornaments, among them models of battle ships, Krupp guns, and so on. He has painted a picture of merit, "Fight between Battle Ships," and it has seemed sometimes as if he lived and moved and had his being in ships. And not only ships of war enlist his enthusiasm, and ships of pleasure, for he is a great yachtsman, but there is no stronger supporter of the new and wonderfully progressive merchant navy of Germany than the Kaiser. He knows to the last sheer-legs the equipment of every German ship yard. In the winter of 1900 he was present at the launching of the splendid new fast liner the "Deutschland," at Stettin, and when she ran on a bar he hurried to send war ships to drag her off. We find the emperor visiting the Berlin decorator who was making the interior furnishings of the new vessel, and giving his suggestions for changes. He telegraphs his sympathy to the North German Lloyd Company when its New York docks are burned, he encourages subsidies for German ships, and he plans for their instant conversion in case of

war to powerful cruisers — for in the end everything stands upon its serviceability to Germany in arms. No detail escapes him or fails to interest him. I shall not soon forget a little anecdote told me by Captain Albers. When the great liner the “Fürst Bismarck” was finished, the Kaiser came on board with Prince Henry to inspect her. He approved everything until he saw the tables in the dining room. Then he said to Captain Albers: “I should think a man who had been at sea as long as you would not allow a cabinet maker to give you square-cornered tables on shipboard.” After the Kaiser left, the table corners were quickly rounded off. Two years later the Kaiser again came aboard the vessel; and when he saw the tables he said: “I see you have rounded off the corners. That is good.” He had not forgotten even a thing as small as this.

The German navy and the advance of German shipping are without doubt the Kaiser’s strongest interests at present. Connected with this hobby, and growing out of it, is his deep enthusiasm for what is now the most striking feature of German development — commercial and industrial expansion. No monarch in Europe takes such a keen interest in the industrial affairs and in the extension of the export business of his domain as William. This interest has arisen largely from the Kaiser’s notable talent for taking a broad view of affairs, a talent developed by

travel in other countries and by persistently endeavoring to look upon Germany through foreign eyes. He and other great Germans have not been slow to see that the future prosperity of the country, with its ever growing population and its ever insufficient agricultural production, must needs depend largely on its success as manufacturer and trader. Hence the Kaiser has taken the greatest interest in spreading industrial and technical education. Not long ago he shocked the conservative educational elements of the German universities by paying special respect and attention to the technical schools. For years without number all academic honors and degrees have fallen to the men who have come from the universities. Now degrees are given to certain technical school graduates, and they are placed on the same level in many respects with the aristocrats of the universities. The Kaiser himself attended the recent celebration of this departure at the famous technical High School at Charlottenburg. Those who know how conservative Germany is in educational affairs appreciate the almost revolutionary effect of this departure.

Besides encouraging more skilled workmen, the Kaiser is not less interested in finding places where the goods which they manufacture may find profitable sale. Hence the strenuous efforts to encourage the building of merchant ships to carry German goods, and the all but feverish desire on the part of

the Kaiser for foreign possessions and foreign spheres of influence. The Kaiser is a shrewd and far-sighted man, and he sees clearly that the great coming struggle among the nations is a struggle for commerce. Virgin continents and islands have now all been occupied; the United States has at last supplied her own vast necessities, and is preparing to enter the foreign market with huge surpluses of manufactured goods; and that nation will prosper most which secures and holds the best markets. Hence the scramble for China; hence the Kaiser's eagerness for more territory, no matter where located.

One of the most significant and impressive recent movements in Germany is the colonial exhibition. Nearly every town of any prominence has had one of these exhibitions or is about to have one. They are given under the auspices of the best families of the place with the ladies of society in charge of the booths. I attended one of the exhibitions at Jena. It occupied a large hall and it consisted of sample products from German colonies, of maps showing the location of foreign German possessions, and of innumerable photographs of scenery, colonial life, and so on. Special attention was given to the men who were governing the colonies, large portraits of each occupying a prominent place in the exhibit. Circulars describing the colonies, inviting immigration, and giving all manner of statistical information

were distributed free. As a side department there was a naval and shipping exhibit which made the usual strong plea for more ships, giving in colored diagrams all manner of statistical information as to German exports and imports, and as to German ships, with comparisons with the activities of other countries. It is probable that no other country ever made such a campaign of education in commerce and industrial expansion. And behind it all looms the irrepressibly active Kaiser with his vast schemes for the advancement of his country. He will have a great navy, and great shipping interests, and great colonial possessions, if he has to bring every peasant in the empire to his palace and convince him with lantern pictures and chalk talks. For the common citizen of Germany who pays the taxes must first be convinced — at least that is the theory !

These two things — his navy, and his desire for commercial expansion — must be set down as the Kaiser's greatest interests. William has been accused of having a universal interest, of being a sort of kingly dabbler in everything. An emperor must of necessity possess wide interests, and yet one who watches the Kaiser's activities will soon perceive that, after all, he is like other men ; he has his great passions and his lesser ones. He cares little, for instance, for science or for horse-racing. He loves travel ; he entertains high respect for religion, a

religion of his own stern Mosaic kind; he dabbles in art and music; he cares nothing for social affairs unless they have some specific purpose or unless they reach the stage of pageantry in which he is the central figure. But among all his lesser likings nothing occupies such a place as statuary. He is preëminently a monument-lover. Not long ago he said to a friend: "There are thirty-four sculptors in Berlin." He knew every one of them personally and he knew all about their work. Nothing pleases him better than to visit them and to be photographed among the litter of the studio. Every one knows of his astonishing adornment of the great central drive through the Thiergarten with a magnificent row of statuary, each group representing one of his ancestors and two of that ancestor's foremost counsellors. This statuary is all in white marble, magnificently done, and erected at the Kaiser's personal expense. Indeed, the Kaiser has watched and criticised each statue as it grew under the sculptor's hand, and has presided at the unveiling of each. It is characteristic, also, of the Kaiser that he has selected a place for a statue of himself which shall match those of his ancestors.

This work has been done not only because the Kaiser is a lover of statuary, but because he loves his capital city and wishes to see it beautified, and, more than that, he believes that such representations

of the great men of the nation have a profound educational influence on the people. They are visible symbols of what patriotic men can do. The Kaiser is ever a profound educator. I shall not soon forget my visit to one of these new statues on a Friday afternoon. From afar I saw a great crowd of children gathered around it, and as I approached I saw that it was a school class, and the master was standing there in front, telling the story of the king and his two counsellors, while the mute statues gave his words a reality that must have impressed them indelibly upon their minds. I learned that this method of teaching German history was pursued to a great extent in Berlin; and whatever may be said of the Kaiser's vanity in thus setting up a row of his ancestors for worship, one cannot but feel that he had another and a profoundly useful purpose in the work.



III

THE GERMAN PRIVATE SOLDIER

III

THE GERMAN PRIVATE SOLDIER

Who he is and How he is Made



THREE words, the facets of the same idea, will express the national atmosphere of Germany : order, system, discipline. From the moment one sets foot on the soil of the Fatherland, particularly if he enters by way of the French border, he feels this atmosphere. It radiates from the soldierly railroad guard who stands sharply at "attention" at the crossing as the train rushes past ; he feels it in the forests all planted properly in rows, and in the neatly kept railroad grounds and rights of way ; he feels it in the policeman who demands his address, his nationality, his business, and how long he is going to stay, so that he may be properly tagged and pigeon-holed ; and, above all, he feels it in the endless system

—and it is nothing short of a system — of military and civil uniforms, which helps to relieve him of the responsibility of being a judge of character, for almost every other German wears his character on his back.

And this national atmosphere of Germany is, in reality, the atmosphere of the military camp, as the spirit of the government is the military spirit. Indeed, every German is a soldier. I do not mean, of course, that every German actually drills and studies the tactics of war every year; but until he is beyond the years of military service he is always on call, and he looks upon himself as a soldier of the empire. Indeed, after the German has finished his regular compulsory service, he is called back from time to time for a few weeks to keep him in training, to drill him in the new formations, or to give him a clear understanding of new arms and ammunition. His life is divided into exact periods — the actual service period, the reserve period, the *landwehr* period, and the *landsturm* period; and the military authorities always know just where to find him and at what call he must shoulder arms. As he grows older, there is less likelihood that the government will put its finger on him; but in cases of great danger even the old *landsturm* must march forth. Every boy is born a soldier, his birth is registered with the authorities, and twenty years later, with automatic precision, he is called upon to do duty. As a consequence, when

one speaks of the making of a German soldier, he deals to a large extent, at least, with the greater subject of the making of a German citizen, and indeed with the making of the German nation.

Germany has no regular army in the sense in which that term is used in America and in England. There are no regular private soldiers who enlist for long periods of time and make soldiery a business. Germany is wholly without a counterpart of that picturesque character, Tommy Atkins, who has served everywhere in the world, and who knows no life outside of the army; nor has she any type corresponding to our own hard-riding, dare-devil regulars. Although a country of soldiers, it is a curious fact that Germany has produced little or no soldier-boy literature — literature in which the English language is so rich. There is little glamour in soldier life to the German, no heroes adorn the service; soldiery is simply one of the plain duties of life — if pleasant, to be enjoyed; if disagreeable, to be endured. And so, although Germany is a nation of soldiers, the soldier does not exist. Even the noncommissioned officers, although they serve for longer terms than the privates, and learn more of the business of soldiery, do it not so much for the love of the service or because it has irresistible attraction for them, as in the case of the English or the American “noncom,” but with the definite purpose of making it a step to better

things in civil life. For after all is said, the German has no Irish blood in him; he is not a natural-born fighter. And yet he does his duty in his German way with absolute faithfulness, serves his time and is proud of it afterward. But because he does not become intoxicated with the military life like the Frenchman, there is no reason why he should not be a good fighter.

It is curious that a nation thus deficient in military enthusiasm should become, by common consent, the greatest of military powers, with the most perfectly organized fighting system and the most perfectly trained individual soldier.

The German army, like the German nation, has been squeezed into existence. Germany, open on every side to attack, has been the great battleground of Europe through all the centuries; and by constant pressure within and without, the army has had its growth. It was the result of stern necessity for defense. It was defense or death; and that, in spite of the commonly reported military aspirations of the German *Kaiser*, is the keynote of the system. The army must be made powerful enough to defend the country from the attacks of any one power or all of them together. If it is necessary to march into France in the course of such a war, well and good; but that is not the fundamental purpose of the army.

And this idea of defending the Fatherland is, sig-

nificantly enough, the idea which animates every citizen German. In France, the popular attitude is just the reverse. There an army is for attack, it is a weapon for offense, and whenever the army becomes about so strong, or when an ambitious officer arises, immediately there is talk of war with England or Germany or some other nation. There have been signs recently that the attitude of Germany, in high official circles at least, was changing, that a new spirit of conquest and extension had been born (witness the Chinese expedition); but if that is so, it has not yet affected the German citizen-soldier.

To the old "inevitables," death and taxes, the German adds a third, military service. From the time he is old enough to go to school, he looks forward and plans for it. It is said that the first great event in the life of a German boy is his confirmation, and the second his first week as a soldier. A huge red placard appears one day on the bill-posting tower so familiar to German towns. It contains a list of the names of all the young men in the district who have reached military age, and his is among them. He has been expecting it, and he knows that the authorities never forget. Already he and his parents have decided one important question regarding his service, and that is, whether he shall enter as an *einjährige freiwillige*, or volunteer to serve for one year only, or whether he must take the full service of two years.

It is safe to say that every German boy has an ambition to be a *freiwillige*, but with the greater majority of them it is an impossibility. For a *freiwillige* must have had a certain amount of schooling, or his mental training must be sufficient to enable him to pass a specified examination; and then, more difficult still, his parents must be financially able to support him while he is in the service, even to the extent of paying for his board and clothing. It is the demand of the government that every boy must serve, be his family rich or poor, noble or common; but the government assumes that the bright, capable boy will learn the drill and the instructions more quickly than the dull peasant boy, and, besides, the *freiwillige* system relieves the government of the support of a large number of soldiers, and, as I shall show later, economy is a cardinal virtue in the German military system.

The physicians reject great numbers of the boys the first year, because they are not yet large or strong enough to bear the rigors of the service, and they are called again the next year. Boys with serious physical defects, such as the loss of the trigger finger, or color-blindness, or curvature of the spine, are rejected entirely, usually to their keen regret. A few others also escape — cases in which a boy is the sole support of a widowed mother, and similar instances. But the authorities always keep a jealous eye on those

who slip through, and should their conditions of life permit, within a reasonable number of years, they must do their service with the others. So few Germans escape service entirely that it is a matter for mild suspicion and inquiry when a man says he has not served. The first question that a would-be employer asks a man is, "Have you done your service, and where?" If the answer is in the negative, the next question is, "Why not?" for it is argued that if this man escaped he must have some grave physical defect or else he must be cumbered with a family to support. Indeed, the sentiment of Germany is strongly against the man who has not served his time, and the boy who finds himself rejected by the examining physicians for any reason is frequently heart-broken, al-

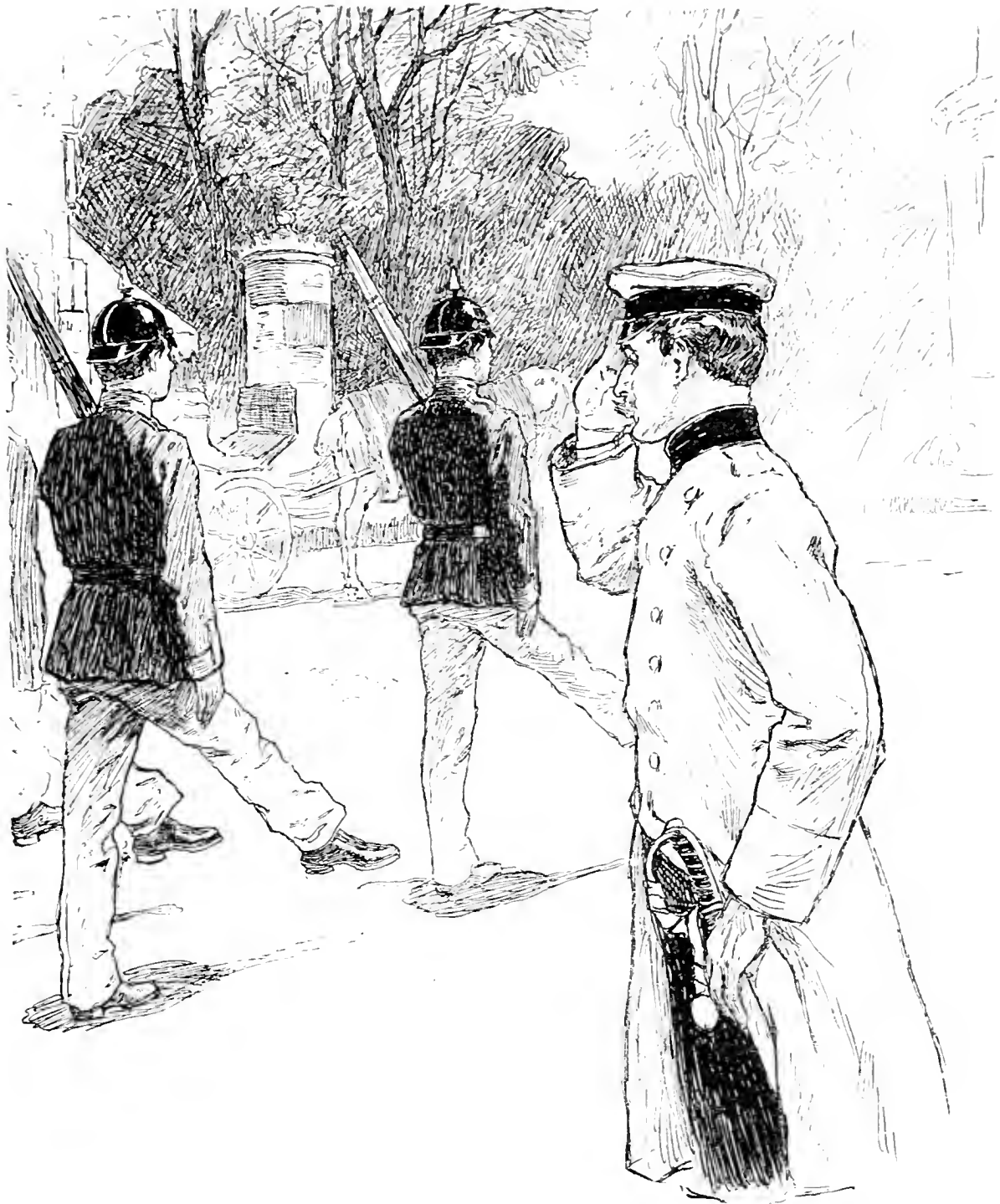


Present Arms

though, of course, there are many who would willingly escape with any excuse.

Under certain conditions the *freiwillige* men and sometimes the two-year men may choose the regiment in which they wish to serve, for some regiments are more aristocratic than others, and they may sometimes select the branch of the service which they prefer, whether infantry, cavalry, artillery, or engineers, although the great proportion of the men are assigned at the will of the officers. Service in the cavalry and artillery requires three years but there are men who are fond of horses and who choose the cavalry because it is *schneidig*, a word best translated in English slang "swell," although the work in the cavalry is more severe.

A regiment is never made up entirely of new men. In the first place there is the skeleton framework of the noncommissioned officers (I am not considering here the commissioned officers) and usually a large residue of men who have already served one year. To these the new draft, awkward, callow, apparently hopelessly stupid, is added, and the officers are confronted with the discouraging task, old as armies, of beating this raw material into shape. The new recruit spends his first few weeks pretty closely in barracks. His old suit of clothes is packed up, labelled, and stored away, to be kept and returned to him when he finishes his service. He is fitted from



The Goose Step

among the oldest uniforms in the possession of the regiment, and he is set to such dispiriting tasks as cleaning barracks and other duties quite as disagreeable to a boy who has been brought up in fairly good surroundings. Such tasks as these are anything but a pleasant introduction to military life, but here comes in the national spirit of order and obedience to authority, and he obeys. The greatest man in the world to him just now is his corporal, whose business it is to knock off his rough corners, and none too gently. His first sergeant, the "mother of the regiment," is a planet as yet a little out of his orbit, and his captain is a fixed and distant star to be looked upon with awe and wonder. One of his first duties is to learn the "soldier marks" — the distinguishing uniform of his officers and how he must salute his superiors. In Germany, the code of etiquette as between officers and men is very rigid. The private is taught that he must obey every order of a superior absolutely and unquestioningly, and that he must invariably salute in exactly the proper way. Any one who visits Germany will see this saluting process on any corner. A sentinel comes to present arms, and follows his officer with his eyes like a faithful dog until he is out of sight. A marching squad goes through that difficult, and, to the uninitiated, that amusing performance known in olden times as the "goose step." Each man in the line raises his legs, thrusts out his

foot vigorously in front, and brings it down with a sharp stroke on the pavement. And thus "goose stepping," he marches until the officer has disappeared.



Company Tailors

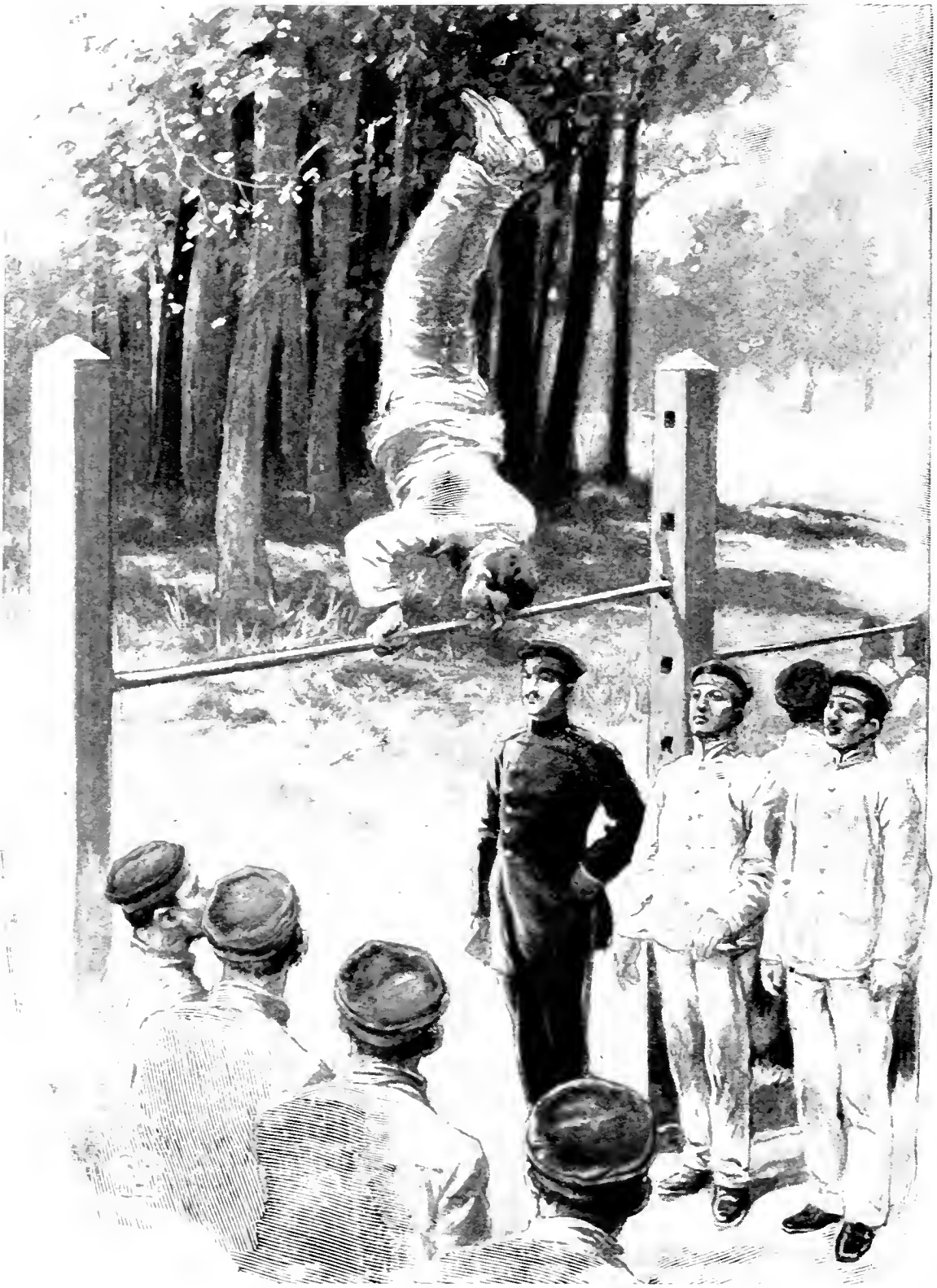
The recruit is also taught the purpose of each article in his uniform and how it must be kept, and, what is more, he is held strictly responsible for every damage. Every button is looked after in a way which would astonish an American regular, who, by the way, is the most costly and careless soldier

in the world. One has only to watch a coat or boot inspection which sometimes lasts for an hour, and to see the officers examine every seam and wrinkle, to be persuaded of the care taken. Not only are there regimental tailors and shoemakers detailed from among the men of those trades, but each young soldier is taught how to mend his clothing and to patch his boots, so that they always look well. Many regimental commanders take so keen a pride in preserving the uniforms of their men that they pile up great stocks of clothing in store. I heard of one regiment that possessed six complete uniforms for every man. As a consequence of this rigid supervision, there is no soldier who looks neater and cleaner on all occasions than the German ; and I think it has had a profound effect on the whole German nation, for it is rare in Germany to see an untidy, ragged, and dirty man, however poor, whereas such specimens swarm the poorer districts of London and New York.

After the recruit has become familiar with his barracks, his uniforms, and his officers, he is ready to begin active drilling, at first without a rifle. And this is hard work. Many of the boys are fresh from farm labor, and are already more or less stiff and awkward ; and frequently those from the cities, while more active, are not so strong. The exercise consists in throwing back the arms violently, expanding

the chest, lowering and elevating the body by bending the knees, and many similar movements calculated to strengthen and render supple all the muscles of the body. Then there is the famous "long step." A whole company may be seen strutting across the parade ground, rising on one foot, and balancing there with the other leg extended until the order comes. Then down with the suspended foot in as long a step as possible, and up with the other. This seems simple enough, but when a recruit has been at it half an hour or more he wishes devoutly for something else. The long step is said to make the Germans good marchers, to assist in giving them that quality of strength and endurance which, during the Franco-Prussian war, "marched the French to death." It is a favorite punishment for petty misdemeanors to force a soldier to go through these exercises for so many minutes or hours.

A little later, and, indeed, all through the service of the German soldier, there is constant drilling in all manner of athletic feats, particularly in jumping and climbing. I saw a squad of recruits practising the running high jump. They were all clad in old canvas uniforms of cheap make, their working clothes, and they stood in a line and jumped at the order of the officer. Every one of them was a strapping, round-faced fellow of evident strength, and yet some of them actually could not jump over a string two feet



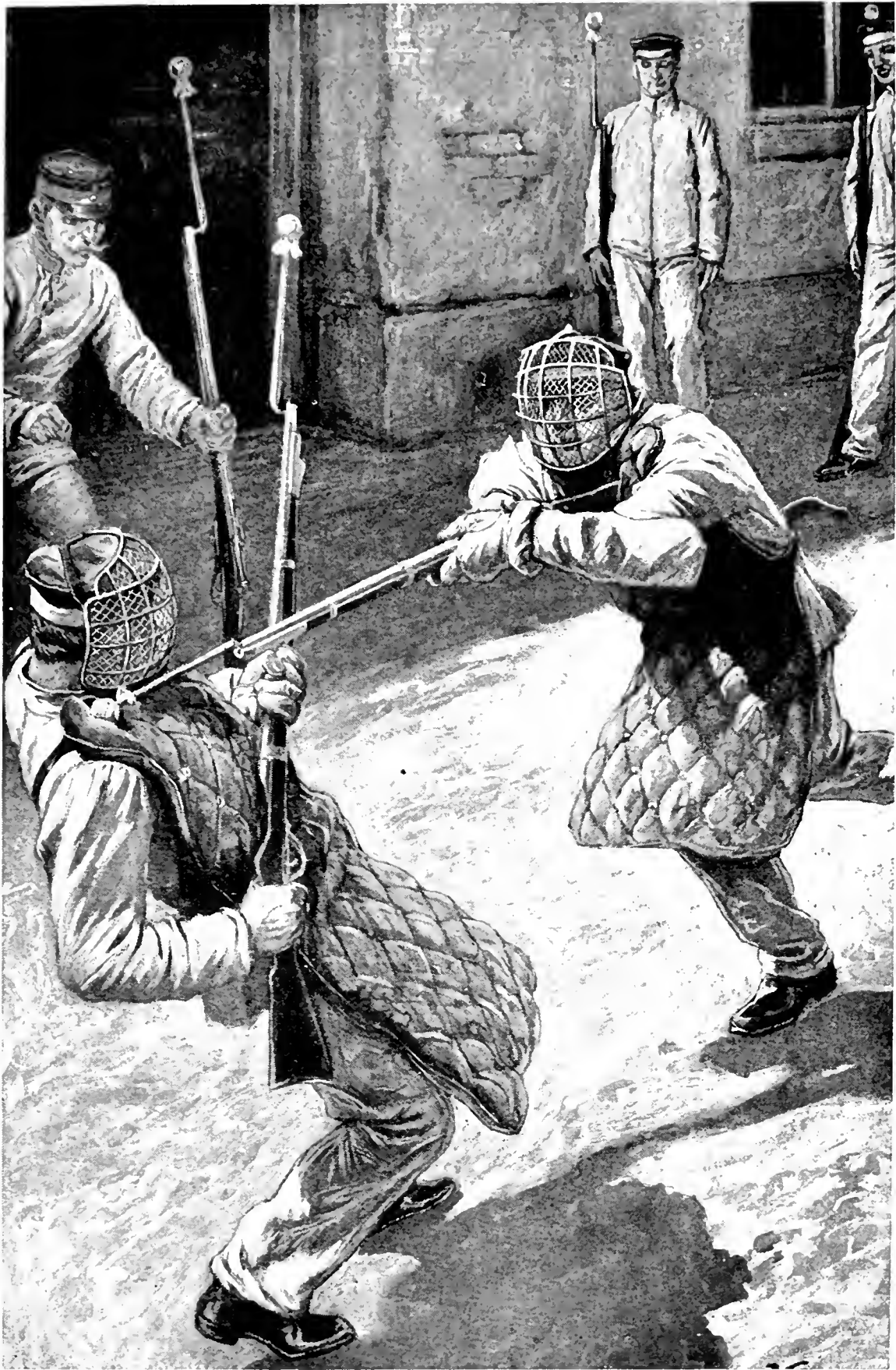
Drill on the Horizontal Bar

high. They had had no training, and they possessed no idea of how to utilize their muscles. But with a year or two of steady training they make good jumpers. More advanced squads are set to work on the horizontal bar; the training here is very practical, with little attempt to teach the high swings and fancy movements. Then there are vaulting exercises and scaling exercises, in which a squad of men are sent charging at a sheer board wall fifteen or twenty feet high, made to represent a fort, and up they go on one another's knees and backs, rifles and all, until every man is on top; and it is astonishing to see how well and how quickly it is all done. In watching these men at their work, one is impressed with the sober earnestness with which every task is performed. There is rarely a smile, never anything like a cheer, and no apparent appreciation of the fact that these exercises are sometimes practised as sport. To these men it is a serious duty, not especially enjoyable, but endurable. No recruits in the world are worked so hard as the Germans; for hours they are kept at this physical training, one exercise after another. Some men it has killed by its severity, but most of them thrive under it, so that at the end of a year many a frail stripling of a lad has become a brawny, bronzed-faced soldier, able to stand any hardship. There can be no doubt that this vigorous military training has had a profound effect on the

German people. The German is by nature physically indolent: he has little love for violent sports such as the Englishman and the American enjoy; he prefers to sit quietly in some little back-yard forest of evergreens growing in tubs and sip his beer. The military training in a measure stirs him out of this lethargy, and gives him the physical strength that he needs.

After several weeks of preliminary training, the recruit is given his rifle. He is required to learn everything about it, the purpose of each part, and how it should be cleaned and kept. Then begins the long training in the manual of arms, a branch in which the Germans are especially proficient. The drill is carried even to practice with the bayonet and bayonet tournaments, the bayonets, of course, being rendered harmless by a clot of cloth wound around the point. I have seen two men, shielded with breast padding and cage masks, fight with much vigor and precision, and give each other some pretty vigorous thrusts. If a modern battle should by any remote possibility reach the point of a face-to-face bayonet struggle, these big German soldiers, trained as they are, would unquestionably make short work of their adversaries.

And now comes the drill in formation, which is not unlike that in other countries, except, probably, in its minute thoroughness. Indeed, thoroughness is the very essence of the German training. Not



Bayonet Practice

long ago I read a criticism in an English paper, anent the South African war, to the effect that the English commissioned officers left too much of the preliminary training, and indeed of regular drill work, to their subordinates, the sergeants and the corporals. In the German army this is not the case; the commissioned officer is never far off, and he is constantly at work with his men, teaching and training them. A familiar sight on a German drill ground is a captain or a lieutenant talking to his company to the length almost of a lecture, advising and instructing. The casual visitor in a German city, who sees the German officers strolling about of an afternoon in their fine uniforms, with their sabre scabbards mirror-bright in the sunshine and their spurs clinking, is quite likely to set these men down as "tin soldiers," rich men's sons who have found an easy and showy career in the army. But if this visitor takes pains to inquire, he will find that most of these officers were out at five o'clock in the morning or before, and that by the time the ordinary citizen is out of bed, they have been for hours at hard work.

Indeed, it is the principle of the German military system to work its men hard, to inure them to all the hardships of war, so that in case they are called suddenly into the field, a forced march will not send them all to hospital. One hot June day I saw several companies go charging across a drill ground



Pontoon Bridge Building

in heavy marching order. They were clad in blue flannel, with metal helmets, and they must have carried at least fifty pounds each on their backs. Every man was dripping with perspiration and choking with dust, but no mercy was shown. They were carrying every pound that would have been carried in a campaign, and they were being trained by hard service to stand it.

Besides the company, battalion, and regimental drill, which is kept up constantly during the entire time of the soldiers' service, there are, every year and sometimes oftener, great gatherings of soldiers from all parts of the empire at what is known as the spring or fall maneuvers. The Kaiser himself, than whom there is no more enthusiastic soldier in the empire, is fond of the pageantry of these great gatherings. Here the men are trained as though on an active campaign, maneuvered in divisions and corps, often in sham battle, some fighting from trenches, some skirmishing in the open, others bridging rivers and effecting crossings as if under fire. The three arms of the service are trained together, so that the infantry will work in perfect harmony with the cavalry and the cavalry with the artillery. In no other army in the world, perhaps, is so much attention paid to training the men, and especially the officers, in these great and necessary evolutions. Many officers can handle a regiment perfectly, but when it comes to

disposing a division in a masterly manner they fall short. And in the German army the ideal soldier is Von Moltke, "the battle-thinker," the man who can dispose great forces with wisdom, not the daring hero who rides recklessly at the head of his men and foolishly risks his life. In this respect the Germans are totally different from the French or the Anglo-Saxons, who dearly love the hero — the man of great personal bravery — and who are quite likely to clamor that such a man be rewarded with a high command regardless of his fitness as a "battle-thinker."

It has been said by critics that the weakest point in the German army is its marksmanship. Thousands of German boys entering service, perhaps a majority of them, have never touched a rifle until it is placed in their hands for drilling. In general, a German is not born with the love of a gun, like an American; and he rarely has an opportunity to use a rifle outside of the service. In America every farmer's boy begins to shoot rabbits as soon as he can hold the old shot gun without wobbling; and as he grows older the love of shooting grows with him, but in Germany there is no such natural training, and the military training is limited, owing to the very great cost of ammunition. And still, the German soldier does much target shooting. He begins with a specially made rifle, in weight and general appearance exactly like the Mauser, but so arranged

that it fires a small cartridge, having a bullet hardly larger than a pea. A miniature target is set up only ten to twenty feet away from the firer, and here he



Rifle Practice with Miniature Target

practises aiming, setting the sight, holding the gun steadily, and so on, thereby saving the waste of larger ammunition. After he has become proficient in this work, he goes to the regular shooting ranges

and is there required to fire a little each week, until he can make a certain score. But it is probable that most German soldiers never come to really familiar shooting relations with their rifles.

While all this physical training and drill is going forward, the intellectual development of the man also goes forward apace. There are regular classes in which instruction is given, not in the familiar branches of the schools, — for every German soldier knows how to read and write before he enters the service, — but in broader subjects. The soldier is instructed as to who is his emperor, who his king, and what his duties are to each; he is given lessons in history in so far as they relate to military affairs, and in the geography of Germany with an idea of the military defense of the nation, of its power and its future. Strange as it may seem, there are men who enter the army with the haziest idea of the Kaiser, some even who have never heard of him and who know little or nothing about their country; all this training is not only in the way of a broadening education, but it stirs the springs of patriotism in the heart of every man, and he goes back to his home, when the service is over, with a new idea of the world and its possibilities. Just here it may be well to mention the fact that the military service has been an important factor in unifying the interests of Germany — the nation, as is well known, being made up of many

rival states and differing nationalities. It has been the policy of the empire, as in Italy, to take men, say from the Polish or Danish or French border, where the sympathies were likely to be anti-German, and scatter them through the Prussian and other intensely German regiments. In this way doubtful borderers are given a thorough training in patriotism, and usually leave the army good Germans with a feeling of pride in the new empire.

The one-year "volunteers," of whom there are about nine thousand in an army of half a million, — the men with the black and white braid on their shoulder-straps, — are not subjected to quite so severe a training as the two-year men. Usually they are required to live in barracks only a short time, and afterwards they may board where they please, provided they are always on time for work. It is common also for them to employ a "putz kamerad" (cleaning comrade), who looks after their clothing and rifle, and they escape much of the drudgery of barracks, but they are compelled to take the same training and drills as the other men. It costs the parents of a volunteer from 2000 marks (\$500) upward to pay his way through a year's service.

Germany is said to manage its military system considering its equipment more cheaply than any other nation. The whole vast army of Germany does not cost the government as much each year as

the United States pays in pensions. The ordinary army expenses of Germany for the year 1900 were \$131,308,900, and the total for the year, including extraordinary expenses, was \$161,500,000. Yet this is an enormous increase over the expense of a few



Cavalrymen tilting with Muffled Lances

years ago, being more than double that of 1872 and half more than that of 1890, showing that military prowess is yearly becoming a heavier burden. And this sum, great as it is, does not include the wages of over a half million men lost to industry,

agriculture, and commerce. According to the estimates of 1900 the strength of the army on its peace footing was 571,692, of whom 491,136 were privates and 80,556 were noncommissioned officers. Besides these there were 23,850 officers and over 5,000 other military officials of various kinds. And not included in these estimates are about 9,000 one-year volunteers who serve at their own cost.

Rigid economy is the watchword of the entire system. Only a rich man may become an officer, for to a large extent he must pay his own way, a major general receiving a salary of barely \$185 a month from the government, while a second lieutenant gets only about \$20 a month, or about the pay of an American sergeant. As for the common soldiers, their pay and board are so meagre that it seems all but impossible that grown men, and hard-working men at that, should subsist and thrive on so little. Indeed, the entire cost of the German soldier to the empire is only \$17.30 a month, and this covers all expenses for food, clothing, equipment, and wages. The pay of an ordinary private is about nine cents a day, but out of this he must pay two and one half cents for his dinner, leaving him in cash only about six and one half cents a day, and in almost every case this small wage must be spent entirely for food. For the only free ration of a German soldier is a huge, thick loaf of black bread, very nutritious, but monotonous

when eaten for every meal, and coffee or soup. The bread ration is issued every three or four days; and upon this and the coffee, with a possible dish of soup in the morning, the soldier must exist, unless he has means of his own, so far as free rations are concerned. At noon, however, he is provided with a sort of meat stew — in America it would be called an Irish stew — which is warm, nutritious, and palatable. This costs ten pfennigs (two and one half cents), and by piecing out with his black bread the soldier makes a very good meal. I asked a German captain what the privates had for supper, and he paused as if a little uncertain. Then he answered, —

“Nothing”: then he corrected himself, “Oh, they always have their black bread.”

This great black loaf is always with them; it is indeed the staff of life. To many of the peasant soldiers it is as good a living as they ever have had at home, but it comes hard on some of the more gently nurtured youth of the cities. The French soldier is fed twice as well as this, and receives a wine ration besides, but the German does not even get his beer; and still a more robust and vigorous lot of men than the privates of the German army could not be found. Many soldiers receive steady supplies of food from home, and great is the receiving day in barracks, what with fat sausages, eggs, and dainties such as only the soldier boy's mother thinks of slipping in.

Small as is the wage received by the soldier, yet the army regulations guard it jealously, for frugality is part of the training. Each soldier places his money in a little bag suspended from a string around his neck. At any time during inspection the officer may



Coat Inspection

demand to have the bags opened, and if it is found that any soldier spends his six cents a day wages too rapidly — think of the wild dissipation which might be had for six cents a day — he is reprimanded and punished. He must make his wages,

small as they are, cover his expenses; he must not spend them instantly for beer.

In the Anglo-Saxon countries the army has acquired the name, unfortunately, of being a hard life morally, and one has to go no further than the works of Mr. Rudyard Kipling to be convinced that the civilian looks upon soldierly peccadilloes with a winking eye. More or less drunkenness and lawlessness, more's the pity, seems to be regarded as the natural and proper pastime of the hero. It is therefore the natural assumption of the English-speaker that a great army such as that of Germany necessarily means much disorder, drunkenness, and immorality, but never was there anything further from the truth. It is a rare thing to see a drunken German soldier; and as for fighting, a single Irish regiment would keep the whole German army well supplied and have a good many broken heads left over. The fact is, the German soldier is worked up to the limit of his strength, and when he is through with a day's exercises he is quite willing to roll into his bunk. Most of the soldiers are poor, with no money to spend on dissipation and all of them have their ambitions for a civil career as soon as they are through with their service. Moreover, it is not in the nature of the German to go to wild excesses in anything. As a consequence, wherever you find him, the German soldier is well-behaved, and apparently always under

discipline. He usually has an hour or two off in the afternoon or evening, and after chapel service he is usually free on Sunday, and you see him neat and



The Soldier's Hour Off

clean, though often awkward and clumsy, parading about the street, frequently holding the hand of a rosy-cheeked girl or sitting in the park, unabashed, with his arm around her. He lacks the inimitable

jauntiness of the English red-coat with his little cap cocked over his ear, and he has none of the activity and sprightliness of the gay-clad French soldier, but there he stands solidly in his big, coarse boots, a serious and simple-minded fellow, intent on doing his duty, slow and clumsy, it is true, but with strength and determination—a soldier every inch of him. He is not good in initiative; his whole training, indeed, the whole life of the German empire, tends to crush out individuality, to train him that he is nothing, and that his company and his regiment and his emperor are everything, that he must obey implicitly. The present Kaiser, in an address to his soldiers, once said:—

“The soldier should not have a will of his own, but all of you should have one will, and that is my will. There exists only one law, and that is my law; and now go and do your duty, and be obedient to your superiors.”

So the German soldier waits patiently for orders; and when they come he obeys, no matter what obstacle lies in the way. And in the next European war he will be absolutely invincible—if he is well led. There lies the test of this splendid military machine—in its leaders.

No stone is left unturned by the government to promote the efficiency of the army. In order to tempt good men to remain after their regular service

and to become noncommissioned officers, a series of civil-service rewards for military service is in operation. A noncommissioned officer who serves faithfully for so many years may become a policeman or fireman, or may be chosen for important service in the government offices. He is also given preference for employment on the railroads, which are government property, and on other government works, and the government service has a degree of honor attached to it which many men covet. As a result of this system of encouragement, the military service has been placed on a high level and the civil service has been filled with military men, and it breathes forth everywhere the slow, methodical, exact, etiquette-demanding spirit of the barracks and the parade ground.

Thus briefly, for the subject is worthy of a large volume, I have sketched the making of a German soldier, of a necessity omitting much of interesting detail, especially regarding the cavalry, artillery, and engineer branches of the service, but endeavoring to give some idea of the spirit of what is without doubt the greatest military system the world ever saw. I have perforce omitted a consideration of the German commissioned officer except incidentally, owing to the scope of the subject and because the training of the German officer, while almost as severe as that of the private and, of course, much more com-

plete, seems to me to be less peculiarly significant of German life and institutions. The German officer belongs to a profession known the world over — like a lawyer or a doctor; the German private is a type peculiar to the German nation.

IV

A VIEW OF THE GERMAN WORKINGMAN

IV

A VIEW OF THE GERMAN WORKINGMAN

His Daily Life, his Earnings, his Wife, his Food, his Clothing, his Problems, and his Relations with his Government

SINCE early morning German workingmen with their wives and children have been coming up from the crowded, red-tiled houses of the town, loitering across patchwork fields and reaching at last the paths along the hillsides. They are clad in Sunday best, poor but neat and clean, with bright patches of color and a certain engaging quaintness of style. The man of the family goes first, his hard black hands clasped behind him, and his wife follows with the children. She is talking in the mellow German intonation with a neighbor further down the hill, who also has a flock of children. Occasionally they stop to rest for a time on one of the green seats provided by some *verein*, and look out over the familiar valley where the town lies asleep in the June sunshine with the lazy breath of banked fires rising from a hundred tall chimneys. It is an orderly gathering, even to the good-humored, prank-

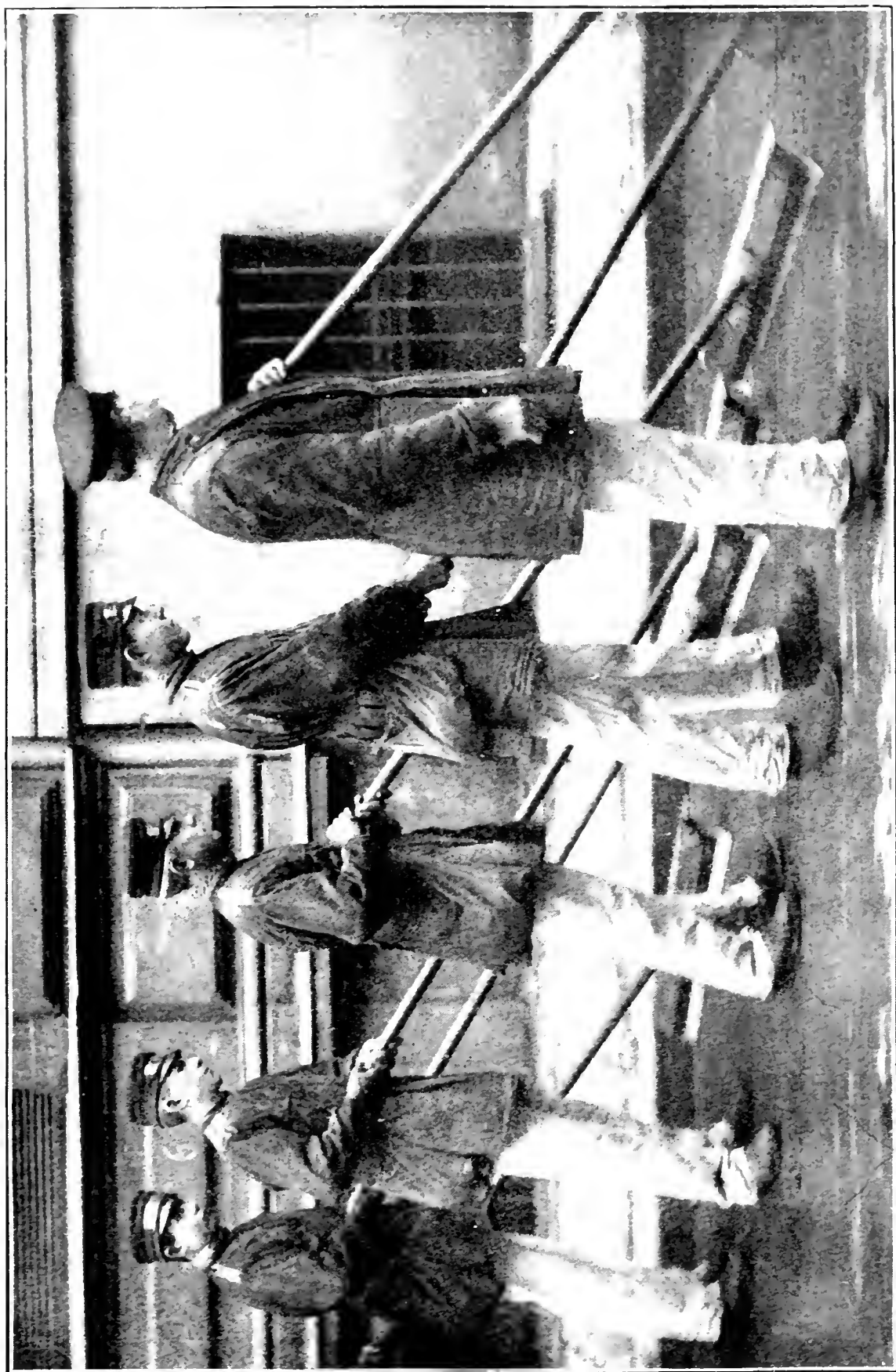
less children, as orderly as the well-kept paths, the pine trees set in prim, clean rows, the white signs which indicate the direction and provide other advice and warning, all the work of a motherly, if severe, government. Thus they stroll upward along the paths, which, though devious, have a way of coming out invariably at a pleasant little inn with tables set outside among the trees. And they never end until the workman is just thirsty enough, and not too thirsty.

Here white-aproned waiters rush about with tall wooden mugs of pale beer and sandwiches of *wiener-wurst*. In a corner a funny little orchestra, three fat men each with a mug of beer before him, is playing two violins and a 'cello. Among these familiar surroundings the workman gathers his family at a table and orders a mug of beer; one does well for all of them, and they drink out of it in turn. When it is empty they have it filled again; three or four in an afternoon, costing ten or fifteen cents (for it is a cheap beer containing little alcohol), are quite enough to give them a glow of friendliness, so that toward evening, when the singing begins, they may all lend their voices with vigor and enjoyment. Here, too, come young lovers hand in hand or with arms around each other, as if it were the most commonplace thing in the world, and they are so evidently and beamingly happy that one cannot but envy them;

they, too, drink out of one mug and divide a sandwich, and say much to each other without caring particularly whether their neighbors overhear or not. The host, a jolly red-cheeked man in a worn black dress-coat, comes often about with his good-humored *Guten Abend* and his pleasant inquiries as to whether the beer is good; and he bows only a bit more solicitously to the well-to-do householder, who sits with democratic simplicity among the men whom he, perhaps, employs, than he does to the workman whose purse allows him only a single mug at a time. Looking upon this jovial gathering, one is almost convinced that here at last is contentment. Apparently these men and their wives are without a worry or a care in the world; here is a taste of the free country after the grimy city, the beer is good, the weather is bright, the music is sweet among the trees, and sweeter still to these born lovers of music, and here are friends and neighbors overflowing with a whole week's gossip. What more could a man want? And when evening approaches, and while the young people's voices are filling the woods with song, the workman goes downward again toward the twinkling city. He is rested and refreshed after the day's enjoyment, having gone to no violent excesses of drink, or food, or exercise, or expenditure. His family has enjoyed it with him, and his children are learning the same simple means of pleasure.

And this is the workman's Sunday as it is spent almost everywhere in the Fatherland. Even in the big, black cities, which are yearly growing bigger and blacker, where there is no escape from streets and houses, the workman still finds, on Sunday, some imitation of the country, perhaps in a high-fenced inn yard where the trees grow in green tubs, and where there is always sociability, music, and beer — that trinity of Teutonic happiness. Somehow, somewhere, not always as happily or as moderately as among the hills of the picture, the German workman finds opportunity for getting a little enjoyment out of life. It may not be of the high order approved by those who have set up Anglo-Saxon standards, and yet one has only to compare the simple, care-free, temperate Sunday of the average German workman with what is too often the spendthrift, viciously idle, and drunken Sunday of many American and more English workmen, to appreciate its worth.

A picture such as I have painted of the workman's Sunday may well seem too brightly colored. It is, indeed, the result of first impressions which were vivid and perhaps over-enthusiastic. But it is true, every line of it — as true as ever a one-sided picture can be — and I have here given it first prominence with intention, because it shows the really fine side of German work-life, the ideal side, the Sunday which makes the other six days of the week at all endurable.



Uniformed Street Sweepers

It is indeed a most vital element of German life which one is too likely to forget in considering the crowding evidences of toil, poverty, and restriction ; the more one learns of the grim and forbidding reverse presentation of the toiler's existence the more keenly he appreciates these rare qualities of temperament, strengthened by centuries of bitter training, which enables the German workman to go on year after year with a smooth brow gathering figs of thistles.

With all its simple enjoyment, it is probable that no civilized workman in the world would change places with the German. For few, indeed, work longer hours for smaller pay, eat coarser and cheaper food, live in more crowded homes, and none gives more in time and substance to a government which in return hems him in and restricts him with an infinite multiplicity of rules and regulations, and curtails his right of free speech, none has less control over that which is his own, for even the spending of a part of his meagre wages is ordered by law, and few there are who possess less influence in making the laws which regulate their conduct. And yet — and here one rises to wonder and admiration — these men have learned how to extract enjoyment out of a life the conditions of which, judged by our standards, are so close to poverty and servitude as to be almost within the bounds of misery.

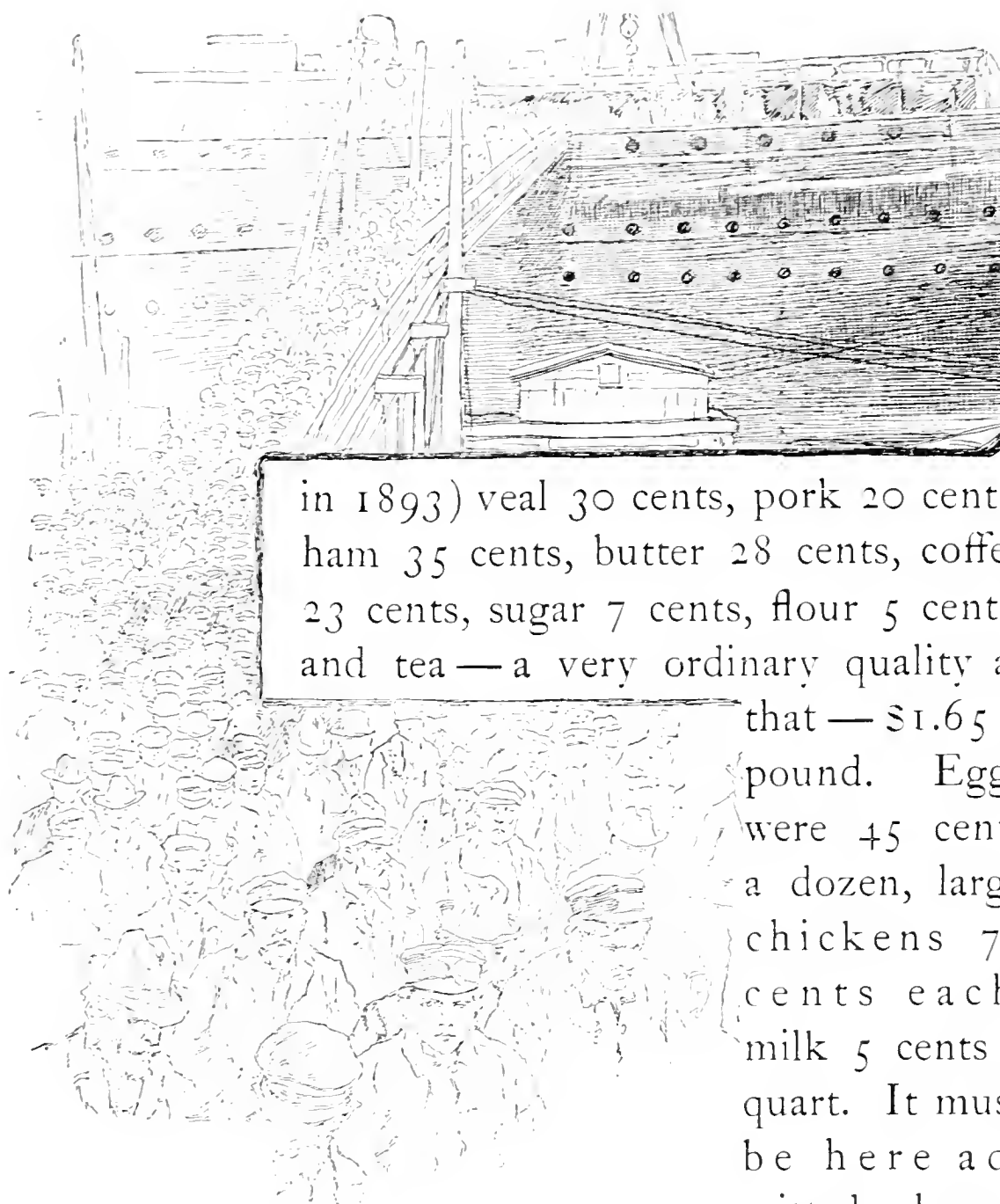
Consider the workmen in the manufacturing and

ship-building towns of northern Germany, where industrial development and prosperity have caused a demand for every sort of labor which equals or exceeds the supply. Practically there are no workmen out of employment, neither men nor women, and wages are generally higher than they ever were before in Germany. Here one sees the workingman under what would seem to be the most favorable conditions. Yet in many respects, as I shall point out, his circumstances are by no means as satisfactory as they were several years ago, and there are signs that, though his patience has seemed unlimited, even he is beginning to feel and chafe under the stress of the strenuous conditions of German industry.

The German workingman, even he who is a master of a trade, is supposed to work eleven hours a day or sixty-six hours a week, rarely less, often longer. At Stettin in Pomerania, where there is a great ship-building establishment, iron works, and many other manufactories, a carpenter in the ship yards, as I was informed by Mr. John E. Kehl, United States Consul, will receive about 90 cents a day for 11 hours' work. In America a carpenter commonly expects \$2.50 to \$3.00 a day for 8 hours' work, and sometimes more. A blacksmith in the German city earns less than the carpenter, a molder more, or about \$1 a day, a painter receives about 75 cents, while a laborer is doing well to get 55 to 60 cents

a day. Carpenters and other workers not employed regularly commonly earn more per day, or they may do piecework which brings them larger returns. In some parts of Germany, notably in the Rhine districts, wages range higher than those here given, while in other districts which I visited they are lower.

These returns for long hours of work, small as they are, show large increases over the wages of a few years ago. For instance, in 1885 carpenters who now receive 90 cents a day were paid only 73 cents, while painters' wages have risen in the same time from 51 to 75 cents. But if wages have increased, the prices of all sorts of commodities, also, have largely risen, and rent, owing to the rapid growth of cities and the influx of workmen, has gone upward by leaps and bounds. In 15 years the working population of Germany has increased from 7,340,789 to 10,900,000. It was only a few years ago that Germany was famous for its cheap living. A workman could live in comfort for a sum almost unbelievably small. Now, however, the staples of food actually cost the German more than they do the American — a statement which may seem startling enough, considering the reputation of the United States for high prices. In Stettin, beef, which in 1893 cost 14 cents a pound, had risen in 1899 to 23 cents. Mutton was 20 cents (compared with 12 cents



Returning from Work — German Ship Yards

in 1893) veal 30 cents, pork 20 cents, ham 35 cents, butter 28 cents, coffee 23 cents, sugar 7 cents, flour 5 cents, and tea — a very ordinary quality at

that — \$1.65 a pound. Eggs were 45 cents a dozen, large chickens 75 cents each, milk 5 cents a quart. It must be here admitted, however, that in

most of these commodities which among American workmen would be considered absolute necessities of life, the German workman never indulges. He

must have coffee and plenty of it, and a little meat. Butter is practically unknown to him, lard being used in its stead. He rarely uses milk, eggs, or white flour, and he never thinks of buying any of the better cuts of meat. Canned goods, familiar to every American worker, are absolutely unknown to him. His staple food is rye-bread, which he buys in enormous loaves. His wife or his little girl goes to market for this bread and brings it home clasped in her arms, unwrapped. I have seen a little tot of a tow-headed girl staggering homeward with a loaf almost as big as she was, and as she walked she gnawed lustily at the flinty end of the loaf. Indeed, I have heard it said that the eating of this hard-crust bread gives the German workman teeth of unequalled excellence. And this bread is good, thoroughly good. The government, which supervises everything and everybody, guards the rye-bread of the people with jealous care. The bakers are watched, compelled to give full weight, and make good bread.¹ I have eaten it in a number of differ-

¹ The Magdeburg Zeitung of November 2, 1900, contains the following account of a few new regulations proposed by the Imperial Ministry of the Interior for the regulation of bakeries:

In the future the floor of a bakery must not be deeper than half a meter (20 inches) below the surface of the ground; the baking rooms must be 3 meters (10 feet) high, and must be provided with windows capable of supplying all parts of such rooms with air and light. In bakeries where regularly more than two assistants and apprentices are

ent towns, and it was always sweet to the taste and wholesome. This bread is fairly cheap, costing usually from 35 to 50 pfennigs (9 to 12 cents) a loaf, though it, too, has risen in price with increased demand. Upon this great loaf the German empire may be said to rest; all Germany has grown up on it. It is the basic ration of the German army, and many a peasant can live very well for a considerable time though he has nothing else to eat.

Next in order of importance after the rye-loaf is sausage. In Germany the *wurstwaaren* shops are a sight to interest and attract foreign eyes. Such a variety of sausages, big, little, and middle-sized, brown, white, and black, soft and hard, raw and cooked, covered and uncovered, one never before imagined possible. Step into a sausage shop of an evening, and you will see the German workman's wife in all her glory, for here she finds the truest outlet for that feminine shopping instinct which even

employed, separate rooms must be provided for the preparation and the baking of the bread. The number of persons employed in each room must be so regulated that at least 15 cubic meters (530 cubic feet) of air is available for each person. The temperature in the working rooms must not exceed 35° C. (95° F.), and there must be connected therewith heated dressing and washing rooms which the employees can reach without exposing themselves to drafts. In cases where these requirements cannot be complied with without rebuilding, during the first ten years, nothing will be required beyond the correction of serious evils which can be effected without much expense.

here has taken root. Shall she buy brown or white; shall she have one slice of a big blood sausage or a ringlet of little liver sausages? And usually she goes away with a stick of dry *wurst* about the size and shape of a policeman's club and for purposes of defense quite as useful. But this sausage, too, is wholesome and good, though growing always dearer, for the government never allows the sausage-makers a moment out of its surveillance. Indeed, it may be said that nowhere in the world is the food generally purer than in Germany. The most stringent laws against adulteration have been enacted, and everything is inspected and reinspected by a cloud of officials. I have had meat served me at table on which I could make out plainly the inspector's blue stamp. And that is one great advantage which the German workman possesses over the American and English.

After sausage comes cheese. One is never at a loss in a German city to find a cheese shop. Just go outside and sniff, then follow your nose. I presume that there is not such a cheese shop in America, unless transplantations have been made in Milwaukee or Chicago, as these curious little places in every German city. Here are cheeses in great variety, both as to size, as to strength, and as to price; I have not gone to extremes in trying these cheeses, but some of the less pronounced are very good indeed.

These are the main articles of the German workman's diet. To these he adds plenty of black coffee, unsweetened; occasionally he has meat soup, potatoes, cabbages, or other vegetables, and frequently dried and smoked fish, of which the German markets present a great variety. This is the regular diet; and the workman — indeed, the entire lower half of Germany — departs little from it, although varying conditions in different sections of the country change it slightly. Added to this food there is invariably beer in as great a quantity as the workman can afford. This beer, though often poor and weak, is always unadulterated and as wholesome as beer ever can be — the government looks out for that.

Usually the workman has five meals a day. To work eleven hours, especially if he lives miles from the shop or factory, which is often the case, a man must be stirring at cock's crow. As soon as he is up, usually in the gray twilight, or in winter by candle-light, he has a cup of strong, hot black coffee and a wedge of rye-bread. This is the first meal. Second breakfast comes about eight o'clock; and if a man is working, he stops at that time and sits down for a few minutes while he eats. Again he has black coffee, hot if possible, and rye-bread with sausages or cheese. Then comes the long nooning of an hour or sometimes longer. It is a sight well worth seeing, the rush of workmen from a German factory at noon.

Usually for fifteen minutes or more before the whistle sounds, short-skirted, comely women, girls, and old men have been gathering at the gates with baskets and bottles ; and at the sound of the whistle they all



Noon Hour

rush in and are swallowed up by the outflowing current of men. Dinner is the most pretentious meal of the day. Usually there is meat soup, sometimes with the meat from which it has been made, boiled potatoes, or some other vegetable, bread, and beer or coffee. Having finished eating, the men

drop down to rest, saying little, thinking little, and waiting for the whistle to call them back again. The German workman is for the most part silent, slow, heavy, and apparently without emotion on these working days. He seems always tired. At four o'clock in the afternoon there is another meal, called vespers, for which there is a recess of ten or fifteen minutes. More coffee from the little blue dinner-pails and a wedge of rye-bread, spread, perhaps, with lard, and the workman is ready again for his task. The last meal of the day comes after nightfall, when the toiler reaches home; it is as simple as the others, consisting of the inevitable coffee or beer, bread, smoked fish, or sausage or cheese. That is all; and when it is eaten the workman is quite ready for his bed, especially if he has had to walk several miles to and from his work, as many do. And this must continue year after year, for German families are large and there are always little mouths to feed. No American workman would think of living as cheaply as this; and yet the German does it, partly because he cannot afford more food and partly because he knows of no better way, yet he has enough, coarse and plain though it is, to keep him well, with perhaps fewer doctors' bills to pay on account of stomach troubles than his rivals in other lands. The total cost of the food for a family of a man, wife, and two children during one day

has been estimated in Pomerania at about thirty-five cents.

I have been told that the German system of frequent meals and frequent rests assists greatly in enabling the workmen to endure without injury the long hours of work ; but I should think that the rate of work would be quite as potent a factor. The German works carefully, thoroughly, but with infinite slowness. Every operation is performed with almost machine-like steadiness ; but there is nowhere a spark of that briskness, that electricity of expending nervous force, which one feels in a great American workshop. The German has saved his nerves ; perhaps that may help to account for his stolid endurance.

Not only does the German workman eat cheap food, but he lives in the cheapest quarters — often not more than two or three rooms even for a large family, and frequently one of these is without windows. Yet the home is ordinarily pretty well kept up, as the homes of workmen go. There are often flowers in the windows, for the German, both high and low, loves his flower-garden, even if the comfort within is small. There is little kitchen equipment and fewer dishes. The workman's wife has no knowledge of cooking except in its most primitive form. The family food, as I have shown, is nearly all bought in a form ready for consumption — bread, cheese,

sausage, dried fish, beer. Soup and coffee require a modicum of skill in cookery, the vegetables merely requiring boiling. Give a German woman of the lower class a new article of food requiring cooking, and she would not know what to do with it. All this is the result, in part at least, of untold years of practical serfdom on the part of the German peasantry from whom these workmen have sprung—a peasantry which was, and still is to a large extent, fed from the kitchen of the landlord, like house-servants, so that both men and women might work without loss of time in the fields. The simplicity of a diet largely cold or bought ready to eat, and the haste with which all culinary matters are swept aside, may be set down as one of the influences which has maintained cheap labor in Germany, but it has left the Germans as a nation the worst cooks in the civilized world, and it has not tended to raise the estate of the German woman, nor to develop an attractive family life.

Rents vary greatly with conditions, of course. In Stettin, Mr. Kehl informed me, apartments of two or three rooms in tenement houses could be had for \$2.25 to \$2.50 a month. The municipality insists upon clean streets and sewers in tenement districts in all parts of Germany; and in certain towns, notably in Krupp's city of Essen, an effort has been made to give especially good homes to the

workingmen, although the rents are not lower than elsewhere.

Clothing, such as workmen wear, is cheap in Germany, almost the only necessary of life that is cheap. Leather shoes, being very expensive, are comparatively little worn, except on Sunday. In their place the workman has his *pantoffels* made of a thick wooden sole, the toe being covered over with leather. In winter these are worn with thick, home-knit socks, and in summer they are frequently slipped on the bare feet. One imagines that they slide off easily, but I have often seen boys who wore them run at the top of their speed, there being an art in turning down the toes when the foot is lifted and clamping the *pantoffels* so that they cannot slip off. The clacking of wooden soles on the floors of a German workshop is a sound quite foreign to American ears. The old-fashioned blouse falling from a yoke at the shoulders is still worn by German workmen, though it is disappearing.

Coal costs at Stettin \$4.52 a ton — that is, soft coal; kerosene is much more expensive than it is in America.

It will be seen, therefore, that while food and other necessities of life with the possible exception of clothing are as high or higher in Germany than in the United States, wages generally will average hardly more than one third as much. Yet the German

workman is able to exist because he is willing to do without all sorts of comforts familiar to every American workman.

I have described the conditions as I learned about them in Pomerania because it seemed necessary in such an account as this to be specific; but I have kept always in mind my own observations as well as the published reports and statistics concerning other parts of the empire. Professor von Halle of the University of Berlin, who has made a very close study of industrial conditions in and around Stettin, informs me that the extraordinary growth there has served to increase rentals and prices of commodities very rapidly. He also found that Stettin was one of the first stopping-places for the great tide of workingmen which is constantly flowing from east to west. The Rhine districts of Germany, the centre of the coal, iron, chemical, and other industries of the empire, are the great loadstones of labor. Raw peasants from the Russian border stop at Stettin and other Baltic towns, and at Breslau, remain for a time and then go on westward looking for better wages, and finding conditions equally hard. Indeed, this silent march of empire westward has so drained some of the eastern districts of Germany that numbers of Russians and Austrian Poles and Bohemians must be brought into the country yearly to help with the agricultural operations. The same conditions exist

in southern Germany, where the Italian is making his appearance, as in America, to do the hard manual labor. Few of these foreigners, however, are allowed to remain, even though they may wish to do so.

One of the strangest influences upon the development of the German workingman has been his compulsory military service, and it is very far from being an unmixed evil, though it demands two of the best years of his life.

It has certainly had a profound influence in training the German to obedience, methods of order, hard work, plain living, and frugality. It has also braced him physically. On the other hand, it has tended to weaken individuality, deaden the initiative faculties, and to produce a state of helpless dependency upon authority. Moreover, it has encouraged the tendency of the young man to leave the farm, so that to-day farm-work in Germany is almost exclusively in the hands of women, and agriculture is in an alarmingly demoralized condition. Take the young peasant from the fields, dress him up in a uniform, show him cities, teach him to handle himself well, give him a glimpse of the opportunities and earnings of industrial pursuit, and it is hard enough, when his army service is finished, to drive him back to the plodding underpaid life on the land. As a result of this, and of the vast demand for workers in the factories, there has been a steady flow of men from the farms to the

cities. In 1882, 42½ per cent of the population was engaged in agriculture; in 1896, 14 years later, the number had been reduced to 36 per cent. Farm work has fallen almost wholly into the hands of women, and a decreased production of food stuffs in proportion to the population, with the necessity of importing food from abroad, has been responsible in large part for the increased prices of commodities. Indeed, the Agrarians, the land-owning lords, predict the ruin of agriculture, and are clamoring for protection (which means the exclusion of foreign food stuffs), a demand which the government has not dared to admit except in a very limited degree (like the practical exclusion of American meat) for fear that prices of foods will go so high as to cause serious disturbances among the industrial classes.

Military service has also had its powerful influence in continuing and confirming the low estate of womanhood in the empire. Half a million men constantly under arms, removed from wage-earning industries and receiving nothing from the government which employs them, make it necessary for just so many more women to work in the fields and at other labor of the most menial kinds. One sees them not only on the farms, but everywhere in the cities, passing brick, stirring mortar, sawing wood, digging ditches, loading lumber, and doing all manner of heavy labor. And yet the woman must bear

children and take care of her home: the result is that many workingmen have little or no home life; it is smothered out by toiling wives. Children are often left in charge of neighbors or in nurse homes and get little home training, — a condition which has certainly coarsened the moral fibre of the German. Infant mortality is very high in Germany; in places it seems to a stranger as if every fourth child was bow-legged or at least weak in its legs. The Germans call this malady *englische Krankheit* (English sickness); why, one does n't quite see, for the disease is rare in England. It is due, as I have been informed, to lack of proper nourishment and to beer. The workingwomen of Germany number something over 2,000,000. The empire could not do without their services, and yet the competition of so many cheap workers in the labor market tends to keep down wages, — a condition which has received much consideration by German thinkers.

To an American observer nothing is more striking than the attitude of the German government toward the working population of the empire. Its leaders, from the emperor down, are unequalled for the lively intelligence with which they recognize conditions and for the promptitude with which they act. It is perfectly plain to them that the hope of Germany lies with the manufactories; therefore the industrial classes must be trained, protected, and encouraged.

One who follows public discussion of the subject — for instance, in the Reichstag — is curiously impressed with the attitude of insensibility toward the individual desires or hopes of the workman. As a man he is not to be considered for an instant; but as an implement to carve a way for Germany to industrial and commercial greatness, to colonies and a vast navy, he is very precious indeed. Everything is done, therefore, that can be done to make this implement keener, brighter, and more efficient. The individual is nothing, the workman everything. Hence the military service teaches the young man implicit obedience to authority, makes him a perfect servant in the hands of the great governing power, and teaches him to rely implicitly upon it. And during every moment of his subsequent life the workman treads a pathway plainly marked out for him by the infinitely numerous rules and regulations of the government. When a workman is born he must be baptized in a government church and obtain a government certificate, he must be confirmed to religion in a government church; if he marries the same power issues the permission and stands sponsor for the ceremony, and when he dies he is buried under government supervision. He must not say what he thinks freely, as the Englishman relieves his mind in Hyde Park or the American assails the administration from the political stump, for if he

talks too much about how he is being governed he is likely to be clapped in jail as a disturber of the peace. He may not even spend his money wholly as he pleases. Instead of allowing a man to have



A Typical German Workman

his wages and to do what he pleases with them, giving him the self-discipline of learning to save and plan against the rainy day, the German government says to its workman: "You must be frugal, whether you want to or not." Consequently tens of thou-

sands of workmen must buy little cards, paste stamps on them for every week, and turn them over to the police at the end of every year. These cards insure the workman against sickness and accident and relieve the wants of his old age, so that if anything befalls a workman, he does not become a charge on the state or on the employer (who, indeed, pays part of the premium for the insurance). This has made poverty almost unknown, and, considered from the point of view of a financial and governmental enterprise, it has been vast and successful beyond praise. Indeed, one in every 20 persons in the empire has been supported at some time by these insurance funds. In 1897 there was a reserve fund of over \$202,500,000, and the amount of insurance paid to the sick was over \$26,000,000, to those who had suffered accidents over \$15,000,000, and to the aged and feeble over \$14,000,000. Moreover, there are many other aid and pension systems, both state and private, many workmen even being compelled to insure in a death fund so that their funeral expenses may be paid and they may be laid away in the little green cemetery with cast iron crosses perhaps containing their tintypes at the head of their graves.

And so, year after year, the workman goes on sticking stamps, — and the police sees that he never fails in this respect, — having little responsibility for the future, or for the welfare of his family, knowing

that whatever happens the funds will support him. He depends absolutely upon the great, powerful, dim government above him to take care of him and shield him from harm. He is not especially interested in organizing trade unions, though sometimes he does indulge in the fury of a strike. He buys lottery tickets regularly from the lottery, which is also a government enterprise, and nearly all that is left goes for beer and cheap shows. Thus supported and relieved of all responsibility, is it any wonder that the German workman goes smooth-browed and simple-minded to his Sunday enjoyments? These enjoyments are all of the present, and of the senses, material, for he takes no thought of the morrow.

If he does begin to consider his condition, he does one of two things, — he either becomes a socialist or he commits suicide. So socialism, though held down by bands of steel, is rampant everywhere in Germany. Even the emperor once, with characteristic frankness, said to his troops at Potsdam :

“For you there is one foe, and that is my foe. Considering the existing socialistic difficulties, it may be necessary for me to command you to shoot down your own relatives, brothers, and parents, in the streets, which God forbid, but you must obey my orders without murmuring.”

And the extent of socialism, which has few means of public expression, every attempt at real free speech

in this regard being squelched without mercy, is probably not realized even in Germany, though the socialists now cast annually some million and a half of votes in the empire.

As to the matter of suicides, Germany has long been known for its terrible records. Saxony has the highest rate of suicide of any country in the world. Barker gives its annual rate as 31.1 per 100,000 inhabitants, and that of the entire empire as 14.3, compared with a rate in United States of only 3.5 per 100,000, while England shows 6.9. About 11,000 persons kill themselves every year in the German empire, and these belong chiefly to the working classes.

The German method of dealing with the working classes is exactly opposite from the American way. In Germany it may be said that the tendency is to make better workmen ; in America and England the tendency is to make better men. The Anglo-Saxon policy is to "cast the bantling on the rock" and let him work out his own salvation through temptation. In Germany the policy is quite the reverse : the workman is protected from disciplining temptation, and ruled in a thousand ways by the government, instead of being allowed to rule himself. American discipline is from within ; German from without. The German workman is without hope even in religion, for it is rare that a German male workman is ever seen in church

after confirmation ; there is little or no chance for him to rise ; he has before him no possible career in politics, nor any hope of becoming a Carnegie, a Schwab, or a Huntington. Consequently he is without ambition to do his work faster or by better methods ; he is content to do what his father did without thinking, though the all-seeing government is making herculean efforts through its scores of technical and industrial schools, the best in the world, to stir him from his stolid and precedent-bound lethargy. The German workman is slow, therefore his wages are small. It is less expensive in Germany to hire muscle than it is to install expensive machinery. In all sorts of German manufacturing establishments one sees clouds of workmen bending their backs to burdens that in America are borne swiftly, noiselessly, and more cheaply by electricity or steam.

Not only is the government doing its best to stir the workman to greater activity, but in several instances individuals are attacking the problem with energy and success. At Jena, I visited the famous Zeiss lens works, where an experiment of an eight-hour day is being tried, it being understood that the men shall study their tasks and increase the speed of work until they are able to do as much in eight hours as formerly in ten or eleven. The experiment is being conducted with great intelligence both by workers and proprietors. It must be said, however,

that they have much in their favor. The workmen are nearly all young and of the very highest class of intelligence, and the work done is exceedingly fatiguing to eyes and hands, so that weariness caused by a longer day's work tended to reduce the quantity and injure the quality of the product. I was informed by Director Fischer that so far as it had gone the experiment was a success. It is certain, however, that in a great majority of manufactories such an innovation as this would fail utterly, for the workmen are hopelessly unambitious, conservative, and helpless; they prefer to live the old, simple life, get what enjoyment they can and strive as little as they can.

And yet, though the tendency is to do only those things for the workman which will make him a better implement for the service of the nation, there are a few philanthropists who are doing their best to make the workman's life more enjoyable and profitable for his own sake. At Jena I visited a fine free reading room, which will ultimately be expanded into a library. It is the result of private enterprise and is said to be the best if not the only one of its kind in the empire. Heretofore workmen in Jena and nearly everywhere else have had to go to a beer garden or café to see the newspapers and other publications, and there are few opportunities for them to get books anywhere, even if they had time to read them. Curiously enough, workmen who read nearly always

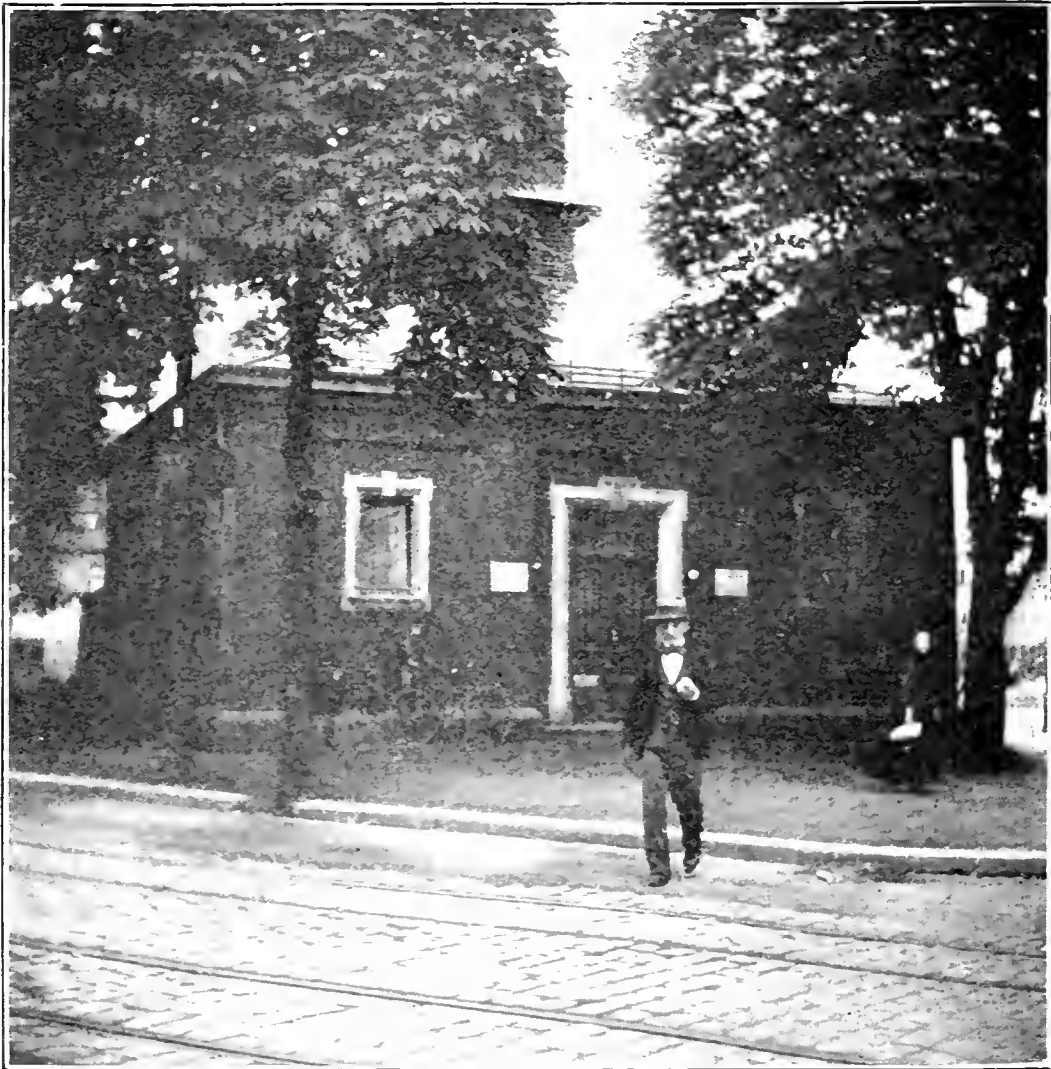
choose science and philosophy, rarely fiction. The parks of Germany are everywhere fine and extensive, and though kept with little reference to the workmen, the workmen are at liberty to use them, which they do to a great extent. Free swimming baths have been established in the rivers near many cities, sometimes by private means, oftener by the municipality. These are popular with the younger element of all classes. At Chemnitz, a large grim manufacturing city in Saxony, where there are immense factories for hosiery, and machinery works, I visited a new free municipal bath. At Chemnitz one may see some of the bitterest phases of the life of the German worker, a hot bed of socialism, a place where lotteries, cheap circuses, and shooting festivals absorb every bit of the workman's surplus money and encourage dissipation. Here, as in many other factory towns, one hears of mysterious and often desperate crimes, committed in the face of a police surveillance unmatched in the world. The bath in question is most thoroughly built, — everything in Germany is thoroughly done, — and is admirably adapted to its purpose. The bath house is a square, one-story brick building, situated in a city square within easy reach of all the factories. I visited it on a chilly Saturday afternoon, and I found the waiting lobbies packed with workmen. Most of them had come directly from the shops, black with grime and grease. Nearly all had

brought a newspaper roll containing clean shirts or other Sunday wear, although many were without any change of clothing. A few girls and women were waiting their turn in a separate room.

In Germany nothing is ever given away, and I was quite prepared to hear that it cost ten pfennigs (about two and one half cents) to use the free bath. The fee, however, was intended, not so much as a charge as a sort of governor for the machinery. I presented my ten-pfennig piece and received a large, clean towel and a bit of yellow soap, together with a slip of paper bearing a number. Then I entered the waiting corridor and took my place on a long bench with the workmen. The walls were of marble, the doors of the baths were yellow varnished wood, and everything about the place was as neat and clean as a New England kitchen.

There were fourteen separate bath rooms, as I remember, on the men's side, and two on the women's side. A boy with a slate kept an account of each bath room. Every man was allowed to stay twenty minutes inside. My companions in waiting were all workmen of the stolid German type, not unfamiliar in this country. Their work clothing was much poorer than that of the American workman. They sat looking before them and saying almost nothing, not even evincing much interest when their numbers were called. I thought of a

crowd of American workmen I had once seen under similar circumstances, and how they had joked one another and laughed and discussed all sorts of



Public Bath House in Chemnitz

questions. Some of these German workmen waited an hour or more for their turns, but not one of them had anything to read, and no attempt had been made to supply the waiting room with papers or reading matter of any description. But they seemed

to enjoy the baths, and the change when they came out was most marked. They looked like new men, and they evidently felt as they looked.

At last my number was called. I entered a very small square room, having a bench at one side and hooks for clothing at the other. Opening from this was a still smaller alcove built solidly of marble with a grated floor. It was invitingly clean. There were hot and cold water faucets which regulated the fall of water from the shower above, and one was able to get a pleasant and satisfactory bath.

I learned afterward that the towel and soap fee, small as it was, nearly paid the operating expenses of the bath, which was becoming weekly more popular. Certainly there never was a more civilizing influence in such a town than a bath of this kind.

One who realizes the mighty industrial progress of Germany is struck with the vital question as to whether the workman will be able to keep pace. Surely the limit of his wages has nearly been reached; he cannot at present earn more; and the manufacturers, who are crowded to narrow margins, between the fierce competition of the Americans and the British, cannot afford to pay more. But the population continues to expand, there being 12,000,000 more people in Germany in 1898 than in 1870, and that almost without immigration; foods and rents are

going up continually ; the government is demanding always more and more for its army, its navy, and its colonies. When will the danger line be reached ? Will the German toiler plod always onward, working always for continually diminishing profits, drinking his Sunday beer, forever the model of patience and simple enjoyment of life ?

V

A GERMAN PROFESSOR

V

A GERMAN PROFESSOR

Professor Ernst Haeckel of Jena

THE German professor occupies a large share in the activities of German life ; indeed, a peculiar distinction attaches to him the world over. Were it not for him Germany would never have reached her present high place among the nations, either intellectually, industrially, or commercially. Delve into the history of many of the greatest business enterprises of the empire — for instance, the sugar beet or the coal tar industries — and you will find a quiet, plodding, painstaking, preoccupied German professor ; and if you seek for the causes for the astonishing perfection and economy with which many German factories are to-day operated, you will find a German professor with a staff of scientists working side by side with the men who operate the machinery, keep the books, and sell the completed products. The German professor is a man simple in his habits and tastes, a hard worker, a cheerful enthusiast, often impractical, sometimes visionary, with an infinite capacity for taking pains,

and in the long run of getting results. Nowhere in the world is scholarship, especially scientific scholarship, honored as it is in Germany; with the greatest solicitude the government nurtures its promising young doctors, giving them chairs in the universities, in the technical schools, or in other State institutions, where, relieved from all financial care and insured of a place for life, the young man may devote every energy to the work of his heart. And if he rises, if he makes some great discovery, he is honored in a manner unknown outside of the Fatherland. The very title "Professor" is instinct with honor. In America any man, poor or rich, ignorant or learned, corn-doctor or savant, may append "Professor" to his name, and no one shall say him nay nor give him the greater honor. But in Germany the title of professor is conferred on a man by the government and carries with it a fixed social position and dignity like that of admiral or general.

And of all the distinguished company of German professors and German scientists none is better known the world over than Professor Ernst Haeckel of the University of Jena. What Huxley did to establish Darwinism in England, Haeckel has done on the Continent. Haeckel has been called the German Huxley, as Huxley was called the English Haeckel. He and the distinguished codiscoverer of the theory of development, A. R. Wallace of Eng-

land, are the last of the great militant evolutionists. He has lived to see the beliefs for which he fought so strenuously forty years ago become the firmly established foundation of natural science, to see the theory of progressive development applied in ways of which Darwin perhaps never dreamed, to see it spread from biology until it has covered nearly the whole range of human knowledge. Forty years ago Haeckel was one of the few thinkers of Europe who supported the theories set forth in "that extravagant book," the "Origin of Species." Now any boy of the schools will tell glibly how man got his ears and why the fine hair of his forearm curves upward instead of downward.

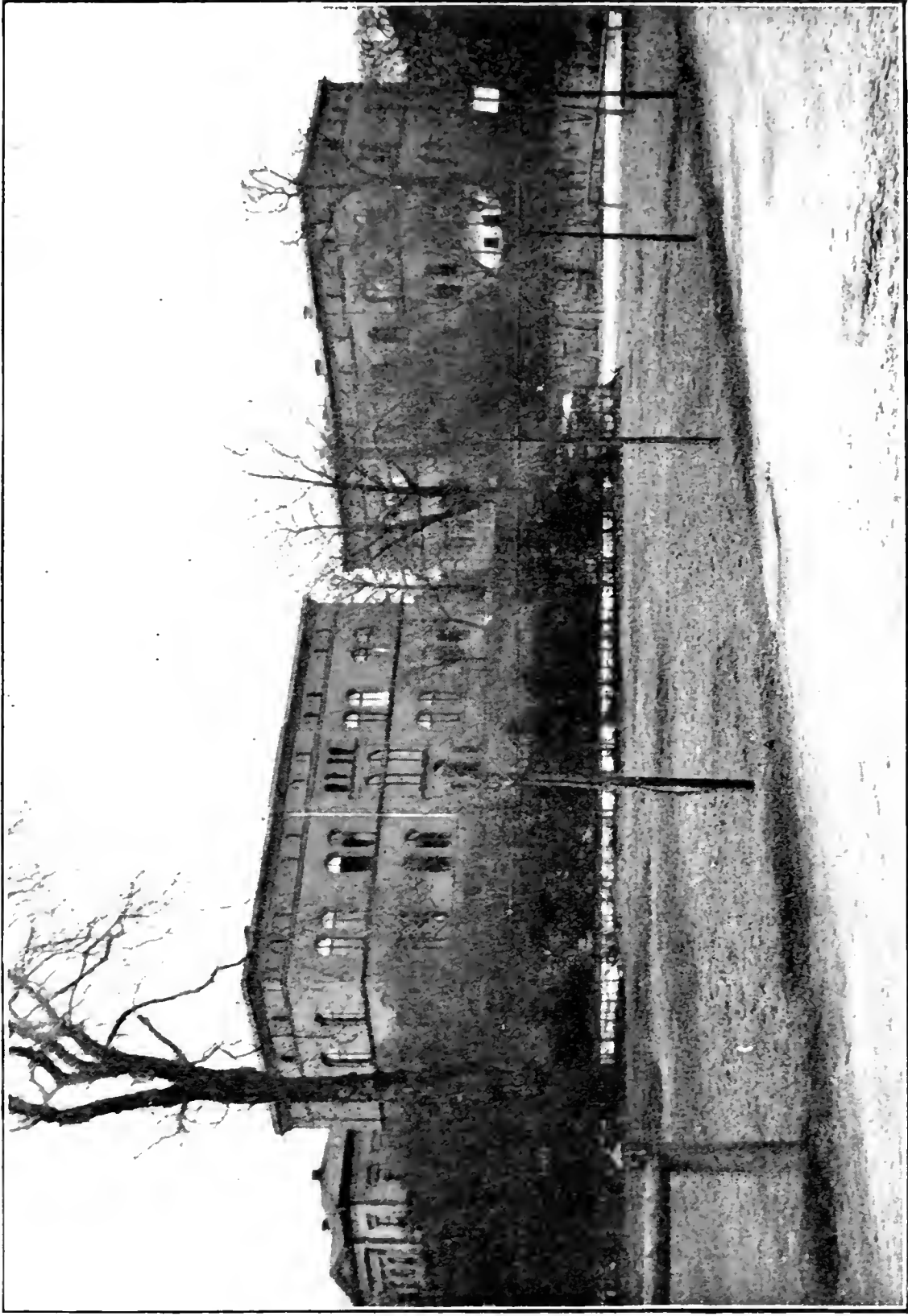
In June, 1900, I visited Professor Haeckel at his home in Jena, where he has lived hemmed in by his books during most of the active years of his life. He comes upon one as a great and genial presence — a man of robust build, both erect and strong, with a thick white beard and keen blue eyes set about with wrinkles of humor. The shake of his hand is warm, and his voice is full and hearty. As you see him among the trees of his garden he wears a broad-brimmed black hat with a dome-like crown. He calls it his "Creation Hat," and he tells you that two just like it are sent to him every year by a man whom he has never seen, but who admires his "Natural History of Creation." He has, indeed, a quaint

story for everything : as he opens the cabinets in his museum he introduces a big chimpanzee as your nearest relative, and then he goes on to show you why the chimpanzee is more closely related to man than the baboon or the orang-outang. He remembers how he came by the baby chimpanzee in the next case. It had belonged to a travelling menagerie, and, as he informs you, it had agreeably chosen to die just as the menagerie was coming into Jena.

“It is not often that a professor of zoölogy has such a fine chimpanzee die at his front door,” he says.

Presently he shows you a collection of pictures, from exquisite engravings on stone which are to form a part of his new work, “Art Forms of Nature.” They are pictures of the lower forms of animal life, medusæ, radiolaria, corals, sponges, and many other forms, and both in drawing and in coloring they are superb. You learn that he himself is the artist who has produced this work, making the drawings and coloring them with his own hand. You suggest how admirably some of these forms of life might be used by an artist for unique and beautiful decorative effects. Instantly he points to the ceiling of his study, and there, painted true to color, is a huge likeness of that delicately beautiful creature of the sea, the medusa.

“I have often suggested the use of these forms of



Haeckel's Laboratory, Jena

life for decorative effects," he says; "the artist must always go back to nature for his best motives."

Professor Haeckel's study is a homely, quiet room upstairs in the Zoölogical Institute of Jena. A table in the centre is crowded with mounted animals. As Professor Haeckel talks with you, his hand rests on a curious specimen of trunk fish from the Mediterranean Sea. At his elbow stands a big black ape with its skeleton counterpart, and at one side there is a fine specimen of that most rare and interesting animal, the duckbill, — the mammal that lays eggs, which has been of such value as evidence to comparative zoölogists. Over his desk in the corner there are pictures of Darwin and of Johannes Müller, the latter being the leading German zoölogist in the first half of the nineteenth century. These two men, with Professor Gegenbaur, who preceded Haeckel in the chair of zoölogy at Jena, may be said to have shaped Haeckel's career. It was the "Origin of Species," read at a time of doubt and indecision, that inspired the young Haeckel to his life-work; it was Müller who schooled him in the new way of studying nature. Some one has said of Müller: "To him every look into a microscope was a service to God." His way of learning nature's secrets was to go directly to nature. The best of his life was spent in the fields and on the seashore watching things as they grew.

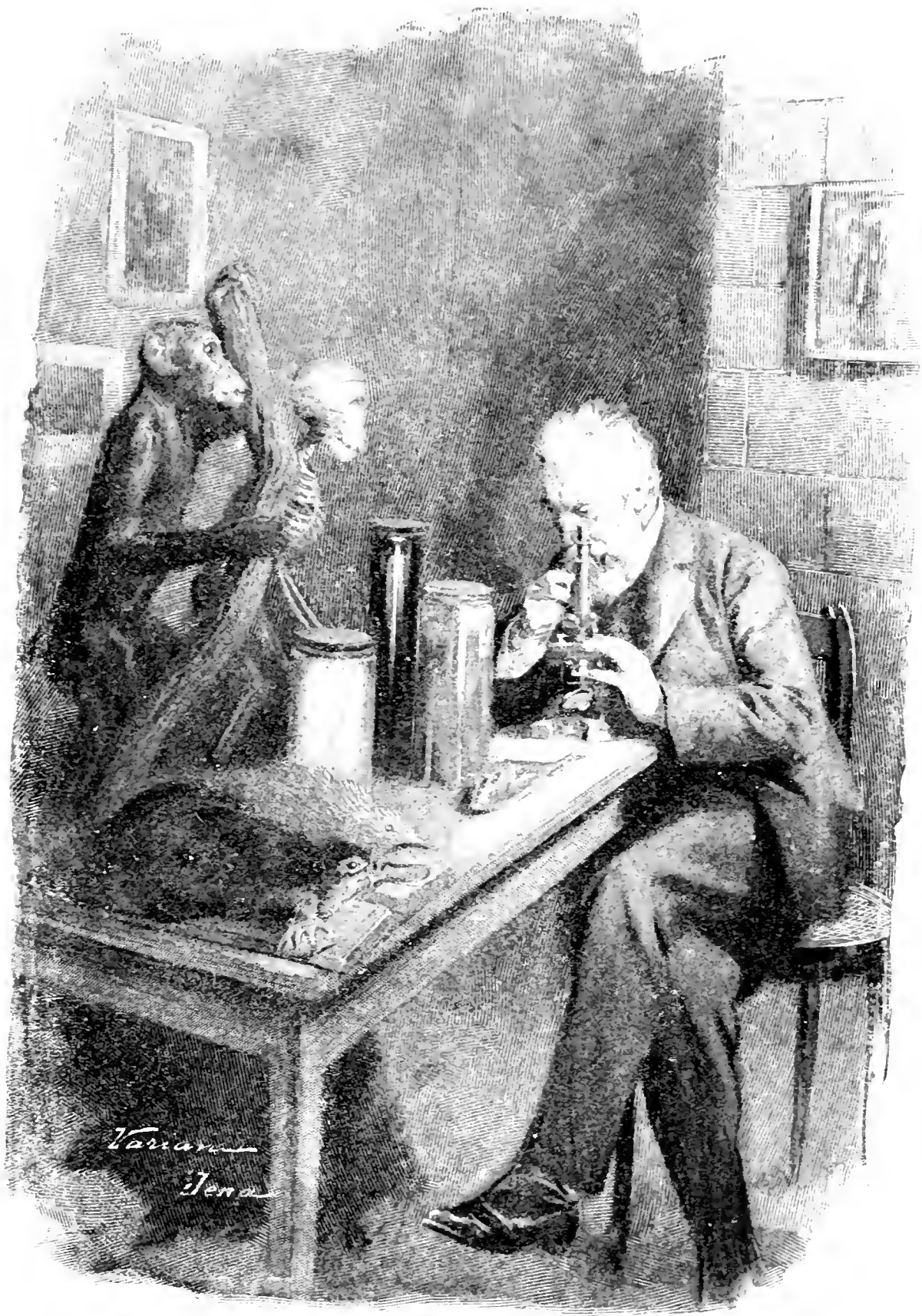
“If once you begin studying this magical world of the ocean,” he once said to Haeckel, “you will see that you cannot be rid of it.”

And thus it was that Haeckel, freshly convinced of the theory of evolution, which indeed he had seen foreshadowed in Goethe, began the minute study of the radiolaria, sponges, corals, and medusæ which was afterwards to yield such rich fruit in establishing the truth of Darwinism. Of a statue bust of Müller Haeckel says :

“Sometimes if I am wearying of work I have only to look at it to win fresh force.”

Everywhere about Haeckel's workroom are books, books in German, English, French, Italian, Russian — one of the most complete of libraries on Darwinism. Professor Haeckel speaks and reads English and Italian almost as easily as he does German, and he is also conversant with French and the Scandinavian tongue. His own books and their different translations and editions fill a good-sized case. One is at a loss to understand how one man could possibly have done so much writing in addition to such a cloud of other work. Here is his first great work, the “General Morphology of Organisms,” in two thick volumes published seven years after the “Origin of Species.” It was written at fever heat to drown the sorrow over the loss of his first wife, — a sorrow which nearly overcame him. He worked so hard at it

that it left him broken in health, and, after all, it was so much in advance of the thought of the day that it made little general impression although it won him, perhaps, a more valuable reward in the friendship of Darwin and Huxley. But the book to-day cannot be obtained for many times its original price. In this library also is Haeckel's greatest popular work, "The Natural History of Creation," which has been translated into twelve languages, reaching its fourth edition in English. It is a wonderfully illuminative and conclusive book to one who would understand the theory of development as applied to the descent of man from the lower forms of animal life, and this in the face of the fact that many people will not agree with Professor Haeckel in his conclusions as to religious faith. Then there are his monumental works on the radiolaria, on the sponges and corals, on the medusæ and siphonophoræ, the five huge volumes of reports on the "Challenger" expedition, and his new (1896) "Systematic Phylogeny," which he regards as his last and most important contribution to science. It comprehends in three volumes on an immense scale a systematic arrangement of the vegetable and animal worlds, living and extinct, on the basis of the theory of evolution, with man at the top and with the lowest, non-nucleated cell at the bottom. Haeckel has written a book of travel, relating his experiences in a voyage to Ceylon — a fascinating book it is too,



Haeckel at his Microscope

and of such popular interest that it has had two translations into English and has run through a paper-covered edition in America. His last book, the "Die Welträthsel" (World-Riddles), which appeared in 1899, has had an unusual sale for a book of science. In its German edition it is a thick octavo volume of several hundred pages, and yet it was written complete in two months. Professor Haeckel's methods of writing this volume will perhaps explain why he has been able to accomplish so much. During all of the two months while he was at work he reached his desk at six o'clock every morning, and he wrote steadily, with a short intermission for dinner, until eight o'clock in the evening. During that time he was secluded in his laboratory, he wrote no letters and saw no visitors, it being understood that he was on a vacation in Italy.

"One can accomplish much in forty years," he says.

Another thing that impresses one who comes to know Professor Haeckel is the amount of work which he does with his own hands. His writing is all done by pen; most of the pictures in his books are the work of his own brush and pencil; his collections of sea creatures, numbering many thousands, have been made largely by his own hand; and often he has done the preserving and mounting, even writing the labels himself. When he travels — and he has been

half the world over — he travels alone, believing that he can thus accomplish more work.

“I am not a friend of many assistants,” he says.

There can be no doubt that Haeckel's surroundings have contributed much to the volume as well as to the high quality of his accomplishment. If there ever was an ideal spot for the unhampered work of a student and thinker, that spot is Jena, a small, quiet, quaint town, removed from the great highways of traffic and shut in from the world with splendid green hills. Professor Haeckel takes you to the window of his study — a view unsurpassed. In the distance rises a spur of mountain where the castle of a mediæval baron once stood, and nearer at hand, hemming in the laboratory itself, there is a beautiful garden which excludes all but glimpses of the town. A pear tree just in front of the window is heavy with white blossoms and busy with bees; just beyond it there is a rustic arbor, shaded from the sun. When Professor Haeckel leaves his work he goes out through a quiet lane walled in with foliage, and a few steps brings him to Ernst Haeckel Street, — so named in his honor by the citizens of Jena, — and then to his house on the hill, also set among abounding foliage. The shady lane which is his daily walk is a historic spot in Jena. A hundred years ago here walked Goethe and Schiller arm in arm, going out from Schiller's house, which one sees

from the window of Professor Haeckel's laboratory. And here is the bench on which they sat and here the stone table; the inscription above will tell about it in Goethe's own words (to Eckermann): "At



Schiller's Lane, Jena

this old stone table have we two often eaten and exchanged good and great words." Here in this garden, also, Schiller wrote his "Wallenstein," in 1798. And a more peaceful spot there is nowhere

in the world than this garden on a sunny June morning. Goethe saw in imagination the great scheme of life, the developing process of nature, when Darwin was a mere boy; and were it not for his fame as a poet he might still be famous for his daring scientific speculations. It is one of those curiously interesting things that Haeckel should have come to work out the great theory of evolution in the spot where Goethe dreamed it, even using some of the same instruments which Goethe had used in his investigations half a century or more before. In all of his books Haeckel mentions Goethe constantly: he has been a deep student of Goethe's poetry, and it is possible that it is Goethe's influence that fired the scientific imagination which has given Haeckel's work its greatest claims to recognition.

Not content with showing the magnificent view from his windows, Haeckel will take you up to the roof. He goes up two steps at a time, although he is now past sixty-six years old.

Away back when he was a student in the university he won fame as an athlete at the famous "Turnfest" at Leipzig in 1863, earning a crown of laurel for breaking the record for the running broad jump. And the vigor of his younger manhood has never deserted him.

On the roof one may see the country for miles in

every direction — magnificent mountain spurs and green valleys, each with its little stream, and each with a clustering hamlet of red-tiled houses. Professor Haeckel tells you that the country is rich in orchids, and that the cliffs, besides being beautiful, are most interesting geologically. Attempts have been made a number of times to tempt Haeckel away from Jena by offers of more important and much better paid places — by the Universities of Vienna, Würzburg, Strasburg, and Bonn, but he will not leave these perfect surroundings.

In addition to his original researches in science, his writing, his lecturing, and university work, which is considerable, one is astonished by the genius Haeckel has expended in avocations, albeit strenuous avocations. At his home he has over two thousand paintings, mostly water colors, some of them of considerable size, besides other thousands of sketches in ink, crayon, and pencil. These do not include his scientific studies of microscopic and other forms of life, which have been used in his books. Among them there are landscapes, and figure scenes painted in Ceylon and India, ruins in Rome, icebergs and mountain scenery in Norway, beautiful sea pictures in Corsica and the Canary Islands, and desert scenery in Africa. Professor Haeckel showed me over sixty of these paintings made in Corsica last year. This work has been done for

the pure pleasure it has brought; but Haeckel thinks it has had greater influence in sharpening his powers of observation, of making him a good seer, for without observing closely and carefully one cannot reproduce accurately in drawing or color. Going over these pictures, one could not help being impressed with the boundless enthusiasm and joy of life that still remained to this young-old man. What keen pleasure the mountains and the ocean had given him as he painted; how interested he was in this curious rock formation, or that splendid clump of palms! One reading his book on Ceylon feels this same spirit of almost boyish delight in every happening and mishappening of the voyage. It is an admirable tonic for one who no longer sees how good the world is.

Years ago, Haeckel tells you, it was his ambition to be a traveler, to see every part of the world, — a scientific traveler, who should make his discoveries of value, but his father preferred to have him a doctor. So he studied at Würzburg and Berlin, and presently was graduated and began practising in Berlin. He relates that in the first year he had three patients all told, but that might have been because he gave the hours of consultation on his plate as from five to six in the morning. When he found that he could not be a traveler, he was fired for a time with the ambition to be a painter, and all the

while he was working prodigiously along scientific lines with Müller and others. But the "travel bacillus," as he calls it, was ever active within him, and years later he was able to make many of the voyages of which he had dreamed in his youth. Indeed, at the time of my visit to Jena, Haeckel was preparing for another voyage to Java and the Celebes. Ever since Dr. Eugène Dubois's discovery in Java of the remains of that curious ape-man, the *Pithecanthropus erectus*, which has been called the "Missing Link," Professor Haeckel had especially desired to visit again this cradle of the human race. His chief object was not to seek for other remains of these first men, and yet he hoped to return with much new scientific material. I asked him if he was not afraid of fever in these tropical countries.

"I never have had a touch of it," he said; "I attribute this to the fact that I am not much of a believer in alcoholic stimulants. Foreigners in those countries usually over-drink and over-eat."

Haeckel's great service to science has been in extending and applying the theory of evolution. In his "On the Origin of Species" Darwin had merely intimated his belief that man himself might also be the result of an evolution from lower forms, but this speculation was so extraordinary that it was left out of the German translations which fell into Haeckel's hands. Haeckel's ready scientific imagination, how-



Professor Ernst Haeckel, drawn from life by George Varian

ever, supplied this deficiency and he at once began his efforts to prove the descent of man. He was the first to outline the pedigrees of the higher animals, showing the development of each and filling in the "missing links" with fossil forms wherever possible, and where impossible suggesting hypothetical forms, and thus he was able to construct an ancestral tree beginning with the simple non-nucleated cell, and reaching upward to man. It was he who first discovered the beginnings of life, minute masses of living matter, or protoplasm, without form and without nucleus. To this he gave the name monera, and he showed how it developed into the higher form of cell represented by the egg cell, having a nucleus, or germ. Many of the terms now in familiar use in zoölogy, such as phylum, ontogeny, phylogeny, gastrula, metazoa, acrania, cœloma, gonades, were invented by Haeckel to suit the necessity of his great classification schemes. It was Haeckel, also, who first brought out strongly the embryological proofs of the theory of development, giving rise to what is known as Haeckel's "fundamental biogenetic law." According to this law every living man is a condensed recapitulation of the whole story of creation. He begins a single cell just as the earth's first living creature began with the monera and simple unicellular protista, and he develops swiftly through all the stages of life, just as the race has developed through millions of years.

Nothing could be of greater scientific importance than the working out of this profoundly wonderful parallelism between the development of the individual and the development of the race. By means of it Professor Haeckel was able to solve many of the difficulties which lay in the path of the application of Darwin's theory and to supply many missing links. His work along these lines is admirably set forth in "The Natural History of Creation." The tracing and comparison of the embryonic development of man, whom he calls a "peculiar two-legged mammal," with the development of the lowest forms of animal life, like sponges and the radiolaria, involved an immense amount of the most difficult original research. In the course of this work he discovered, named, and described many thousands of new species of the lower forms of animal life, giving them nearly all Greek names. In 1868, nine years after the appearance of Darwin's great book, he published "On the Development of the Human Race," and since that time he has been the most indefatigable of workers in completing and correcting the pedigree of mankind. He believes now that the story is complete. Other facts may be added, but they will be details, not essential to what may be called the plot of the story.

I asked Professor Haeckel what, in his opinion, would be the next stages of development in mankind.

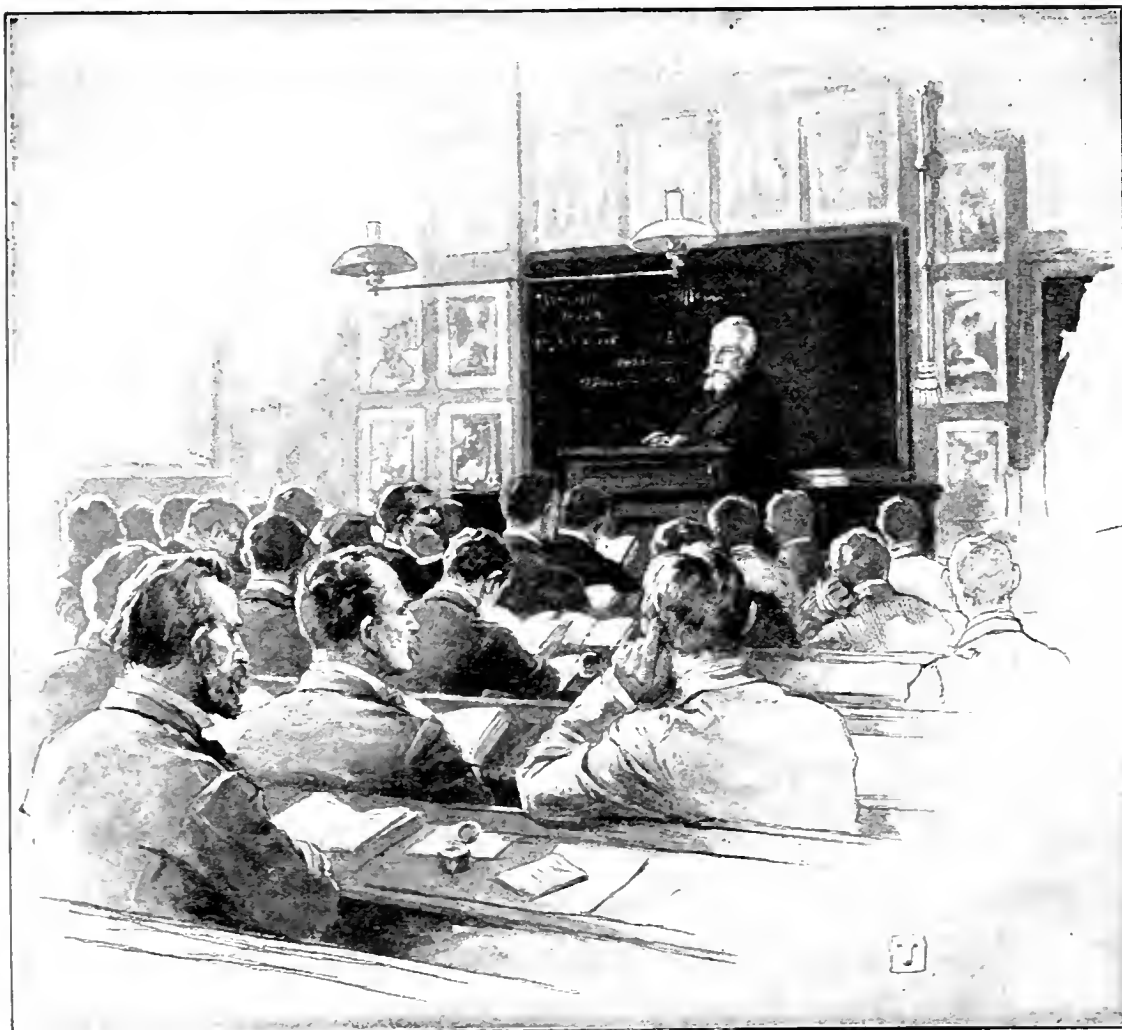
“It will be mostly mental, the evolution of a better and finer brain,” he said; “when man’s brain began to develop rapidly there was no further need for great changes in his body. And yet some physical changes are still going on. Man will probably lose some of his teeth, there being not the use for them that there was, and there are signs that the little toes will also disappear, leaving man a four-toed animal. But these changes are of small significance compared with our mental development.”

There are, however, as Professor Haeckel points out, tremendous influences at work in developing mankind — a vast and fascinating field of study. Man being a product of natural evolution and development, his institutions must necessarily be a like product, and the application of the theory to political and social economy, statecraft and education, are most hopeful fields of work for future thinkers.

“Life was never more complex than it is to-day,” said Professor Haeckel, “and there is no prophesying the exact lines of future development. Man at present seems to be developing or retrograding in masses — by nations, and yet under very different influences. Here in Germany the tendency is all toward the centralization of power in the government, the removal of individual responsibility, and the working together of large masses of men as one man. In America the tendency has been different:

there the individual is developed, he has great powers and responsibilities—the man is the unit. Who shall say how these great influences will work out?”

Speaking at another time of the beautiful and



Professor Haeckel lecturing in his Class Room

accurate pictures of animals and plants now obtainable where thirty years ago there were almost none, Professor Haeckel mentioned this as an instance of one of the lesser and yet important influences of modern life. Pictures convey ideas swiftly and accu-

rately, therefore they serve as a new and powerful factor in education—scientific education in particular. A man may become comparatively familiar with the animal forms of the world in a short time, through the perfect pictures now obtainable, whereas a few years ago it would have taken a lifetime.

Then there are other influences to which Professor Haeckel has often called attention. In Europe there is the influence of what Haeckel calls military selection—all the young men being taken at a certain age, removed from productive labor or study, and put through exactly similar training for one or two years. In America there is no such influence. How will such training or lack of it develop the race? Haeckel also speaks of medical selection as one of the powerful modern influences. Medical science has made great strides in the past few years: it saves many lives that otherwise would have been lost and frequently it keeps people with dangerous diseases alive for years. This must necessarily swell the population largely, the crowding bringing with it new influences. Professor Haeckel also sees other problems in the medical preservation of the weak.

Then there is a still more powerful influence at work: the earth is now almost wholly inhabited; there are few new places for immigration and the development of virgin land—the two influences which have had so great a share in the progress

of the world during the last few hundred years. The contest must now change. Instead of discovering and settling new continents, there must set in a terrible new struggle for existence between the older nations, for instance, in commerce and trade, and the strongest, most easily adaptable, most resourceful nations will win. Professor Haeckel spoke of the remarkable retrogression of the Latin races during the past few decades as a striking instance of this new struggle—especially the retrogression of once powerful Spain. He also called attention to the sudden upward progress of Japan. It is as ever the struggle between the species for existence, and the sharper the struggle within certain limits, the greater the development of the strong.

I asked Professor Haeckel what in his opinion were the next great avenues of development in scientific research.

“I believe,” he said, “that the nineteenth century has been the golden era of science—that there will never again be so many discoveries of profound importance.”

Indeed, he is of the opinion that there are no more great universal generalizations to be made—like the law of the conservation of energy, the attraction of gravitation, and the theory of natural evolution. He thinks the work of future scientists will deal largely with the application of the great principles and gen-

eralizations already well known. By this he does not mean that wonderful new scientific discoveries will not be made, but that they will not have the profound importance of these fundamental laws.

“I look for the greatest future development in the science of chemistry,” he said. He spoke of the attempts now being made to show that the seventy or more so-called elementary substances may in reality be only the forms of a few still more elementary substances, mentioning the speculation that science would one day find that there was really only one substance at the basis of all things—one element of which the so-called seventy odd elements are merely forms of different composition of atoms.

The conversation as to the outlook in chemistry drifted naturally to that subject which has so often presented itself to the imaginative scientist — that of the ability of men to produce a living substance by artificial processes, in other words, to make life. Haeckel believes firmly that some day this will be done, that it is not at all beyond the range of science, strange and improbable as it may seem. We had been sitting at the open windows of Haeckel’s study. The professor pointed outside to the beautiful green foliage of the garden.

“It is only what those plants are doing all the time,” he said, “taking so many parts of carbon, hydrogen, nitrogen, oxygen, and so on, and combining

them into the albuminous substance which we call protoplasm, the living substance. Science can combine these elements just as nature does—the proportions being exactly known—but not yet to produce life. The albumen molecule is very complicated. Science does not know yet just how the various atoms of carbon, oxygen, and so on which compose it are united, and all attempts to solve the problem of the albumen molecule, what it really is and how the elements are joined within it, have been so far without avail. But I believe firmly that this great question will some day be solved. If it is, then the artificial production of life will be a possibility.”

VI

A TYPICAL SCIENTIFIC INSTITUTION

VI

A TYPICAL SCIENTIFIC INSTITUTION

The Physical and Technical Institute at
Charlottenburg

SUCH a government as that of Germany imposes restrictions and assumes paternal responsibilities quite out of keeping with the American idea of the functions of the state, but it also goes as far in the other direction, and showers benefits upon its favored institutions with paternal prodigality. The republic says to its citizen, "You may do what you please, but don't bother me." The monarchy's familiar word is *verboten* (forbidden), but the monarchy also says, "If you have talent and ambition with poverty, I will support you so that your work may help me." And that is one of the prime reasons why Germany to-day holds such a commanding position in science and art, and it accounts in large measure for the recent astonishing development in German commerce.

The casual American visitor may not at first appreciate this liberal side of the German system, and such an institution as the Reichsanstalt, the

Imperial Physical and Technical Institute of Germany, strikes him with astonishment. Here is a splendid establishment of buildings, set in spacious grounds, an equipment of its kind, perhaps without parallel anywhere in the world, having a faculty of ninety-five professors, scientific assistants, expert mechanics, and other helpers, a staff larger than that of many an American university, and yet without a single student or any provision for students, and admitting visitors only rarely. And this institution has for its purpose, primarily, the investigation of abstruse scientific problems, those problems of heat, light, electricity, and magnetism, which lie just beyond the borders of the known. Much of this work offers little promise of what we in America are fond of calling immediate practical results, and yet the inquiries are in reality profoundly practical, inasmuch as they are laying a deep and solid foundation for future scientific discovery. This is the physical side of the Reichsanstalt. A coördinate department, that of technics, seeks to adapt the results of these special researches and to accomplish for advanced mechanics what the physical department is doing for advanced science.

Here in the Reichsanstalt are set up the most perfect instruments in the world for measuring heat and cold, for finding the pressure of the atmosphere, for determining the strength of electric currents, for

measuring light, and for a score of other purposes in which the utmost exactness is required. Here are kept the purest gold, silver, platinum, iridium, rhodium, and other metals in the world—the standards of purity. Here is the purest water in the world, and the finest glass, and the most perfect weighing machines. Here can be produced and measured every temperature from that of liquid air to that of the electric arc light. And here is apparatus for generating electric currents of any potential from one volt up to twelve thousand volts, and, what is more, of measuring them with almost absolute exactness. Does the famous German thermometer-maker wish to know if his thermometers or his barometers are absolutely correct? He sends them to the Reichsanstalt for testing. When Krupp, the gun-builder of Essen, devises a new kind of nickel-steel he sends it to the Reichsanstalt to ascertain exactly its coefficient of expansion in varying degrees of heat and cold, its electrical conductivity, and its tensile strength. When our own government wishes to be certain that the incandescent electric lights which it is purchasing are marked with the proper candle-power, it must needs send them to this distant German institution for testing; there is, perhaps, no other place in the world where it can be done with such certainty. Such a consignment of American lamps had just passed through the Reichsanstalt at the time of my visit. The pitch

of the music which you hear at the opera has undoubtedly been regulated by tuning forks bearing the peculiar blue marking of the Reichsanstalt; the thermometer with which your physician takes your temperature when you are ill, if it be of the best make, owes its accuracy to the same source.

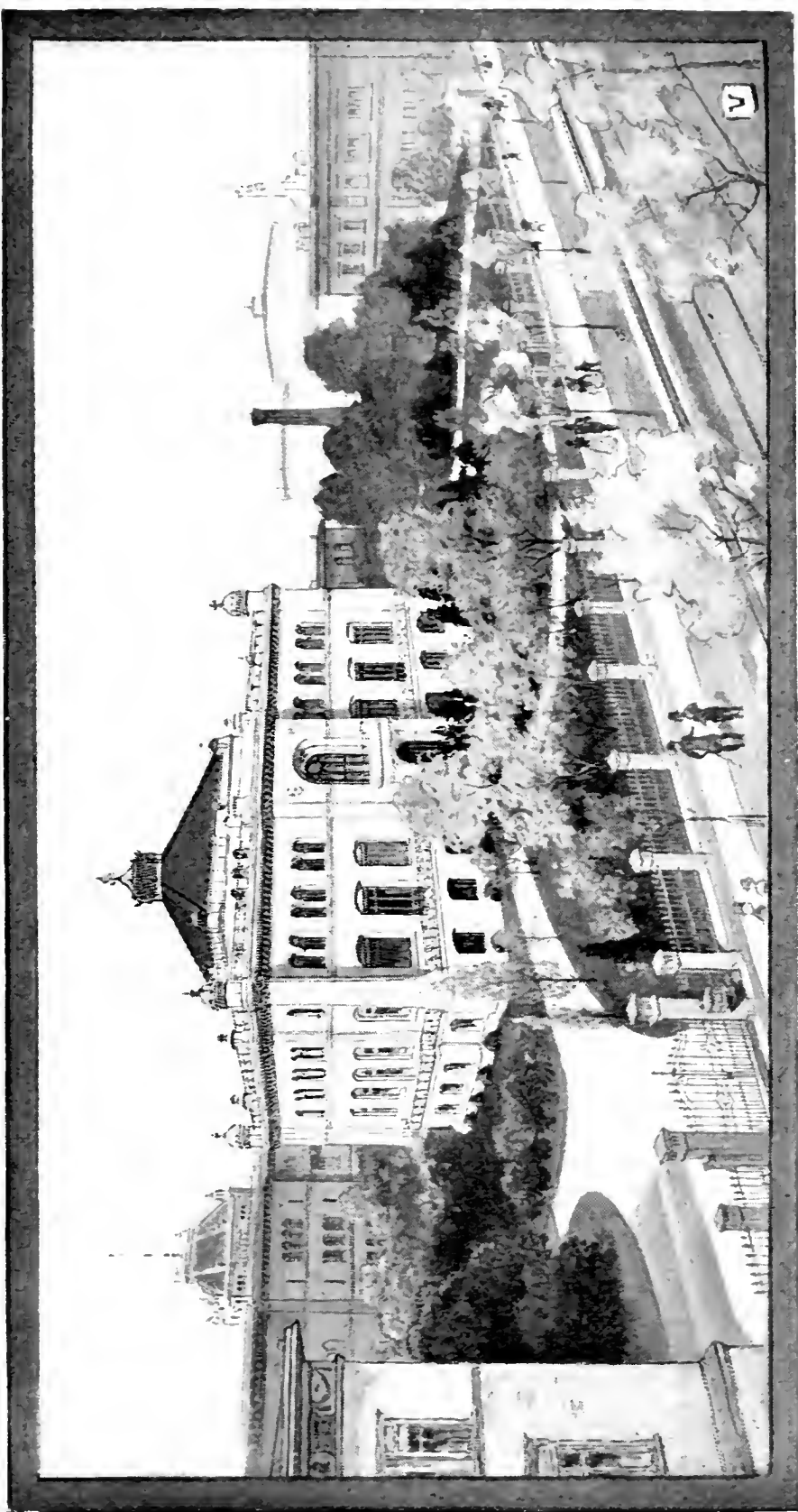
The Reichsanstalt has now been in existence for twelve years, and yet it is rarely heard of even in Germany outside of a limited circle of scientific investigators and technicians, but among these it stands supreme: it is the final authority. It is probable that all the people of the United States, outside of a few colleges and manufacturing establishments, who ever heard of the institution could be numbered within a few hundreds.

All of this work is expensive, its returns in money being a very small fraction, less than ten per cent, of its income, and yet the Imperial Reichstag of Germany makes the necessary appropriations year after year for its extension and maintenance, nor is there any objection because much of the work has no immediate practical value, nor because it benefits not only Germany but the whole world. For the results of the investigations and determinations at the Reichsanstalt are freely published, and whoever wishes, be he American, English, or French, political friend or foe, may use them all. In this large and liberal attitude toward science and the recognition

of its value to the state, Germany must certainly be accorded the chief place among the nations. And this is what impresses the American, whose experience with government has too often been associated with the intensely practical, no money spent unless the legislator can see practical results before the next campaign.

The Reichsanstalt owes its existence to the far-sightedness of those two great Germans, von Siemens and von Helmholtz. Both men were, first of all, scientists, but Siemens, one of the greatest of inventors and manufacturers of electrical apparatus, was also a technician. He recognized the necessity of greater exactness in all departments of mechanics, in standards of measurement in temperature, electricity, and light. He also saw in a broad way that the future of Germany lay in her progress as a manufacturing nation, and he knew that greater exactness in technical processes would not only mean greater speed and accuracy of production with the consequent increase in profits, but he foresaw the advantages which would accrue to the nation which stood for perfection in manufactured articles. "Made in Germany" has now become a commercial by-word. In order to further this idea, Siemens presented the imperial government with a plot of land valued at \$125,000 in the town of Charlottenburg which adjoins Berlin on the west. It is only a half hour's drive from the

emperor's palace, and within sight of that other unequalled German institution, the Royal Technical High School. To this plot the government added extensively by purchase and within three years' time nine buildings had risen out of the sand. The original cost of the establishment, exclusive of land, was over \$1,000,000, all paid by the imperial government. Von Helmholtz, then the most distinguished among German scientists, was called to the presidency of the institution; and it was he with his immediate successor, Professor Kohlrausch, now president of the institution, who organized the work and first indicated the lines of research which it was to follow. Every attention was given to the details of construction, so that the various buildings and the apparatus should be perfectly fitted to the purposes of accurate investigation. Money was not stinted, and it is probable that no other institution in the world is so thoroughly equipped. For delicate experiments in physics, great solidity of construction is required. Therefore the two main buildings were sunk deep in the earth and set on a firm foundation of stone and asphalt, so that an earthquake would hardly jar them. An even temperature is another requirement for delicate experiments, especially in the domain of temperature. Therefore the walls were built thick and solid. I was shown the method of construction in the basement of the physical building, first an outer



General View of the Reichsanstalt Building, in Charlottenburg

wall eighteen inches thick, pierced with tight-fitting double windows, then an air space reaching from floor to ceiling and wide enough for a man to walk in, then an inner wall of solid masonry two and one-half feet thick, also fitted with tight double windows and doors. Still inside of this there are rooms enclosed in masonry walls and having thick glass floors and ceilings, glass being the best heat insulator. These rooms are not artificially heated, and yet they can be kept at a temperature that will not vary winter or summer throughout the year more than two degrees. Each room has its own ventilator to carry off stench and acid fumes, so that in no case can one experiment interfere with another. All the larger rooms are so fitted with extra doors, windows, heating radiators, and lighting apparatus that they can be divided into two or more smaller rooms should extra places be needed for peculiarly delicate experiments. An architect, two masons, and two carpenters are kept especially employed by the year for making these changes and for building the foundation pillars and other conveniences for the experiments. Instead of shingle or tile roofs which might absorb heat, the buildings of the Reichsanstalt are covered with a thick layer of soil, now thoroughly grown up to turf. When I first saw the institution, the grass on the roofs was just turning green and a few dandelions shone out in yellow patches. One small building near the

middle of the grounds seemed at first sight out of harmony with the remainder of the institution. It is set diagonally to the front of the grounds, so that it may rest in the magnetic meridian, and it is built wholly without iron or steel in any form, — no iron nails, hinges, locks, pipes, or anything else of the kind. Here the professors may come when they are working with delicate experiments in magnetism, and all the conditions are propitious. All the buildings give the impression of spaciousness and permanency, and standing, as they do, in the midst of a garden and trees, and shut off from the life of the surrounding streets, they furnish an ideal condition of seclusion and quiet.

Nor has the effort of the government to furnish its chosen scientists with every working convenience been bounded by the limits of the Reichsanstalt grounds. Recently the street railways of Berlin have been fitting their lines with electricity. The directors of the Reichsanstalt feared that the proximity of trolley wires with the magnetic field which would be set up at the passage of every car might interfere with their experiments, and they made representations to that effect to the government. In Germany science is esteemed only second to royalty, and the government being all-powerful, the street railroads were ordered not to place any trolley wires within a kilometer (five-eighths of a mile) of the

Reichsanstalt. As a result and odd enough it is to an American, the trolley lines of Charlottenburg when they approach the imperial mausoleum, the emperor's memorial church, and the Reichsanstalt—royalty and science—are run underground, and the cars are compelled to cover the intervals by means of power drawn from storage batteries. Asphalt pavements also have replaced the old cobblestones in the streets around the Reichsanstalt, to prevent the jar of trucks from influencing the delicate instruments in the buildings. To such an extent as this does Germany work out her schemes for scientific advancement.

In these favorable surroundings the imperial government has placed a corps of scientists of the highest attainments. In this, as in everything else, no pains have been spared to make every condition favorable to great accomplishment. The process of selection of men is, like everything in Germany, methodical and permanent. A student in the university has obtained his degree of doctor with credit, and he wishes to spend his life in science. The government, upon consideration, places him in the Reichsanstalt as a *wissenschaftlichen*—scientific assistant. He takes an oath of office and becomes at once a cog in the vast machine of the German imperial government. In about three years' time he is promoted to assistant with a small increase in salary. Then he serves eight or ten years, more or less, before he receives the

highly honorable title of professor — a distinction conferred by the government just as a colonel would be commissioned in the army. He is now a life member of the government service, and nothing but absolute disgrace ever displaces him. He is free to pursue the work he loves without the care and precariousness of a teaching position. His salary is very small, it is true, very small indeed, but from time to time he receives an increase of a few dollars a year, and, more astonishing to an American, the government regularly pays him his salary three months in advance. At sixty-five years of age he may retire, and his pension will keep him comfortably to the end of his days. But if his salary is small his position in the government carries with it compensation in the form of social distinction which would be much beyond his reach if he were in a position in private life yielding him a much greater income. So the service is eminently safe and conducive to the careful, painstaking, intricate investigations for which German science has long been famous, — the slow piling of minute facts one upon another until they shape a great conclusion. Surely a better machine than the Reichsanstalt for forcing nature's secret storehouses, "putting questions to nature in the form of experiments," as Professor Lummer expresses it, was never devised.

At the head of the Reichsanstalt is Professor

Kohlrausch, who succeeded to the position at the death of von Helmholtz. Professor Kohlrausch is also the director of the first department, that of physical inquiry, and Professor Hagen is director of the second department, that of technics. The cost of the two departments to the government is between \$80,000 and \$100,000 a year. The second department, which has charge of the testing of instruments of precision and measurement, charges small fees for its work, which amount in the aggregate to about ten per cent of the total outgo. The first department, dealing as it does with abstruse inquiries, has no income whatever. Thus physics, for the man engaged in it, is no longer what von Siemens once called "a breadless art — a plaything for academic teachers in their hours of leisure."

In its essence the work of the Reichsanstalt consists in establishing new and more accurate standards of measurement. That is the final purpose of all the experiments: it is, indeed, the chief aim of the science of physics. All modern mechanical operations depend on the employment of heat. Heat generates steam, is changed into electricity, drives steamships, reduces ores, warms buildings. It is, therefore, of the utmost importance to be able to measure heat accurately, for unless it can be measured it cannot be perfectly controlled. It is also essential to measure the effect of heat on gases, liquids, and solids, to find



Prof. Dr. Kohlrausch, President of the Reichsanstalt

out how much it expands them, how and at what degree it consumes or melts or gasifies them. Such knowledge as this is essential to all manner of manufacturing, smelting, power-producing operations, and as the manufacturing processes become more complex and more costly, the greater is the need of scientific accuracy at every step. The pottery maker, for instance, who is able to mix the clay for his fine wares by a certain formula based on a scientific knowledge of the glazing or melting points of each ingredient, and then to fire them in exactly the right temperature, will produce a more uniform product than his unskilled competitor, and his waste will be less. This growing need of scientific accuracy in technics and mechanics has found response in Germany in the Reichsanstalt. And the chief work of the Reichsanstalt in both of its departments deals with heat measurements. It is patiently adding figures beyond the decimal point; in its last report there is an account of a series of experiments which had for its sole object the carrying of certain established temperature calculations from the fifth to the seventh figure beyond the decimal, thereby adding just so much to the minute accuracy of determinations in which this calculation plays a part.

One who watches the experiments with heat determination at the Reichsanstalt cannot fail to be impressed anew with the stupendous difficulties with

which physics has to deal. Science, which sometimes seems the final standard of accuracy and completeness, in the light of these experiments appears unstable, without a sure foundation and without the possibility of a sure foundation, at the best only a series of approximations which may or may not be close to the truth. For all measurement is merely a series of comparisons. We say this room is fourteen feet in width. We mean that it has been compared with a little stick which we call a foot. The ordinary Frenchman would not have the faintest idea of the size of the room from such a measurement because he compares his rooms with a little stick called a meter. Plunge this Centigrade thermometer into this pail of hot water. The top of the thread of mercury touches a nick in the glass marked ninety degrees — a point located at that relative place because an old scientist thought it convenient. The temperature of the water has been compared with the temperature of the mercury, it has caused the mercury to expand a certain amount, and this amount has been measured in small divisions called degrees. This comparative method of measurement would be absolutely accurate and practical for all human needs if it were not for the fact that the measuring instrument keeps changing. Supposing in measuring the width of a room the foot rule should shorten when a cold draft came under the door and should expand or

lengthen as it neared the radiator — as it really does do in a minute degree. Palpably your result would be inaccurate.

Now, just these changes take place in heat-measuring apparatus. Here is your thermometer with the scale carefully cut; it is a good thermometer and it would furnish absolutely accurate measurements of ordinary temperatures if there were some ideal glass that would not also expand and contract with the heat or cold, and that would not change shape, and if the whole length of the thread of mercury could always be immersed in the liquid to be measured so that it would expand as much in proportion as the mercury in the bulb.

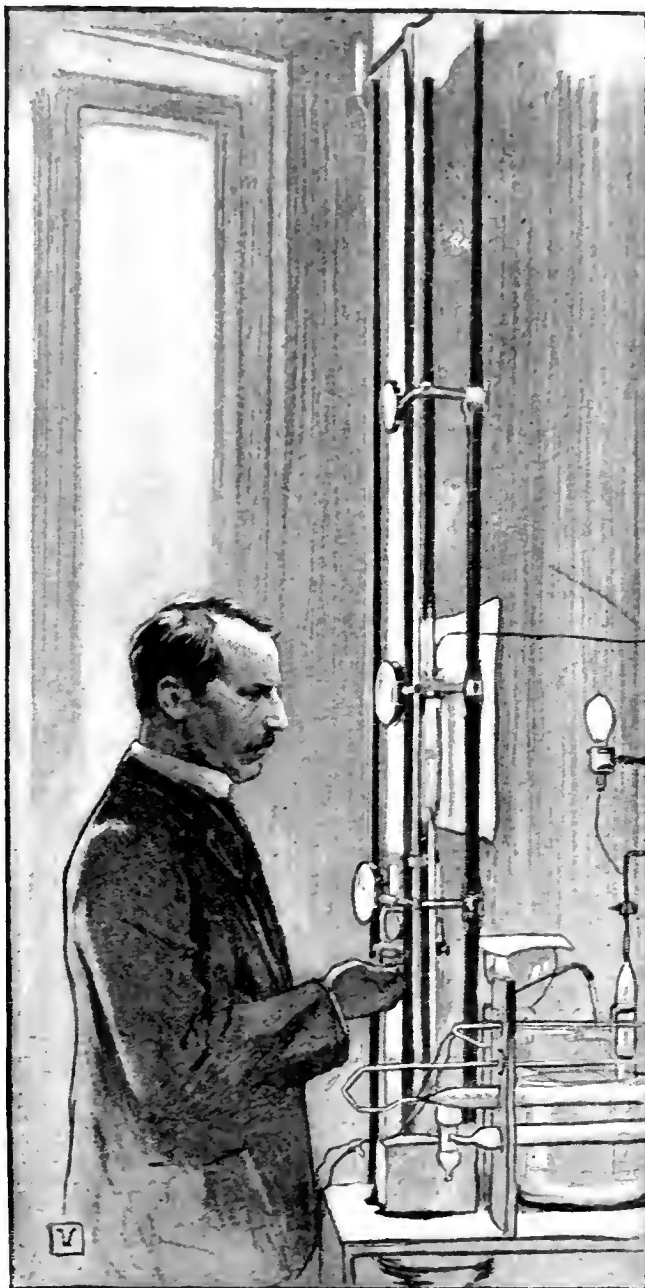
Such an ideal glass thermometer, if it could be produced, would work with what may be called absolute accuracy within certain limits. But even this thermometer, if the temperature went too high, would fail, because glass melts and mercury vaporizes, or if the temperature went too low, the mercury would freeze. Thus everything about us is constantly changing relations, so that there is no standard of anything — no real measure of length, breadth, thickness, weight, heat, light, or electricity. It is, therefore, the tremendous task of the scientist to learn the laws of all these changes and to place them in the forms of curves and diagrams so that they can be worked out mathematically. In this way he can

make his measurements with a changing instrument, and then, knowing accurately from previous experiments how much the instrument has changed while the measurement is taking place, he can make the necessary corrections, thereby catching the elusive truth by surrounding it on every side and binding it down with many cords. And this is the work of the Reichsanstalt: in its first department it works out the deep laws governing substances under the influence of heat, light, and electricity; in its second department the facts thus discovered are utilized in the production of marvellously fine instruments and in making practical tests of other instruments with them.

Early experiments in the Reichsanstalt showed that the glass of most thermometers was defective, that it shrank or expanded or otherwise lost its shape, however minutely, so that the zero point soon changed, rendering all accurate measurements defective. Therefore glass-making became the subject of thorough investigation in connection with the famous glass works at Jena, with the result that a certain superior kind of glass was invented, which, being chemically defined, could be reproduced always in uniform purity. By a system of baking and cooling, this glass was contracted to the last degree, and the resulting thermometer tubes were the most perfect ever made. Attention was then given to securing pure mercury and to marking the scale of degrees

accurately on the tubes. Then the thermometer was tested for variations when it was standing perpendicularly, and when it was horizontal; it was subjected to various air pressures within and without, and the corrections in every case were noted, so that no possible source of error was left unsounded. The result was the production of the world's standard of thermometers, — thermometers that will measure to the thousandth of a degree. One of them that I touched — carefully enough, for they are delicate and costly creations — indicated in the upward leap of the mercury the heat of an instant's contact with the finger-tips. Having thus established a standard mercury thermometer for the measurement of temperatures, from about 30 degrees below zero to 350 degrees above zero Centigrade, with an error rarely greater than one-tenth of a degree, the staff of the Reichsanstalt proceeded to make extensive experiments in the determination of temperatures lower than 30 degrees and higher than 350 degrees. Mercury boils at 350 degrees C., but if it is placed under the pressure of gas within the thermometer tube liquid, it can be kept up to 550 degrees. Professor Holborn, with Dr. Day, who, by the way, is an American, and the only foreign member of the Reichsanstalt staff, has worked with these gas thermometers for over three years with excellent results, obtaining a standard thermometer with a range much

wider than any heretofore produced, — from 30 degrees below zero to 550 degrees above zero. This thermometer would measure temperatures still higher than this were it not for the fact that at this point the glass begins to soften. Beyond 550 degrees, then, other means must be employed, and extensive experiments have been made with what are known as thermo-electric junctions. A thermo-electric junction, such as is used in the Reichsanstalt, is a very simple contrivance of two fine wires about four feet long, fastened together at one end. These wires are of different metals; in older experiments copper and German silver were used, but more recently platinum, iridium, and rhodium — the most infusible



*Dr. Day Experimenting with
Thermometers*

of all metals — have been substituted. When the point of connection of these wires is heated, an electric current is set up, the more heat the more current ; and by measuring this current the temperature at the point of junction may be closely calculated. The Reichsanstalt has successfully used the thermo-electric junction for measurements as high as 1,775 degrees C. with greater accuracy than ever before. Higher than this the platinum begins to melt, thus putting an end to the experiment.

In the same way that high temperatures have been invaded and subjected to measurement, thermometers have been constructed for measuring low temperatures. Dr. Day showed me a thermometer filled with clear petroleum ether, the first result of the distillation of petroleum, — a waste product, by the way. As a result of testing many different substances, the capacity of this liquid for resisting great cold was discovered. It will not freeze even at the temperature of boiling liquid air, although it becomes molasses-like a few degrees further down. By means of this thermometer fairly accurate determinations of heat can be made at a degree of cold hardly conceivable, — at least 190 degrees below zero Centigrade or over 300 degrees below zero Fahrenheit.

By these various means the range of temperature between that of liquid air, 192 degrees below zero Centigrade, which is nearly at the bottom of the ladder of

temperature, to 1,775 degrees, where platinum melts, has been thoroughly explored. Beyond the melting-point of platinum, and up to the temperature of the sun itself, the Reichsanstalt has made probably the best-existing estimates. Indeed, its determinations of the melting-point of various metals — an investigation of the utmost importance to science and mechanics, and as difficult as it is important — are standard the world over. Some of these temperatures, recently announced, may give an idea of the ranges of temperature covered in the Reichsanstalt investigations.

Centigrade Scale.

The sun, estimated	4,800 degrees
Arc light	3,750 to 4,200
Platinum melts	1,775
Argand lamps	1,700 to 1,900
Gold melts	1,065
Mercury boils	350
Water boils	100
Water freezes	0
Liquid air boils	192

The history of the scientific attempts to determine the exact melting-point of gold would fill a good sized volume. Seven years of investigation have been given to it at the Reichsanstalt alone, and the figure above given nearly approaches absolute accuracy.

The work of the second department in testing thermometers and other heat-measuring devices will

show what a practical hold the Reichsanstalt already has on the manufacturers of Germany and of the



Professor Hagen, Director of the Technical Department of the Reichsanstalt

world. Director Hagen, who was for years an associate of von Helmholtz, told me that in 1899 the

Reichsanstalt tested over 77,000 physician's thermometers, sent to them by thermometer manufacturers, 17,000 at the home institute and 60,000 at a branch in Ilmenau. Thousands of other thermometers of various kinds were also tested. The work consists



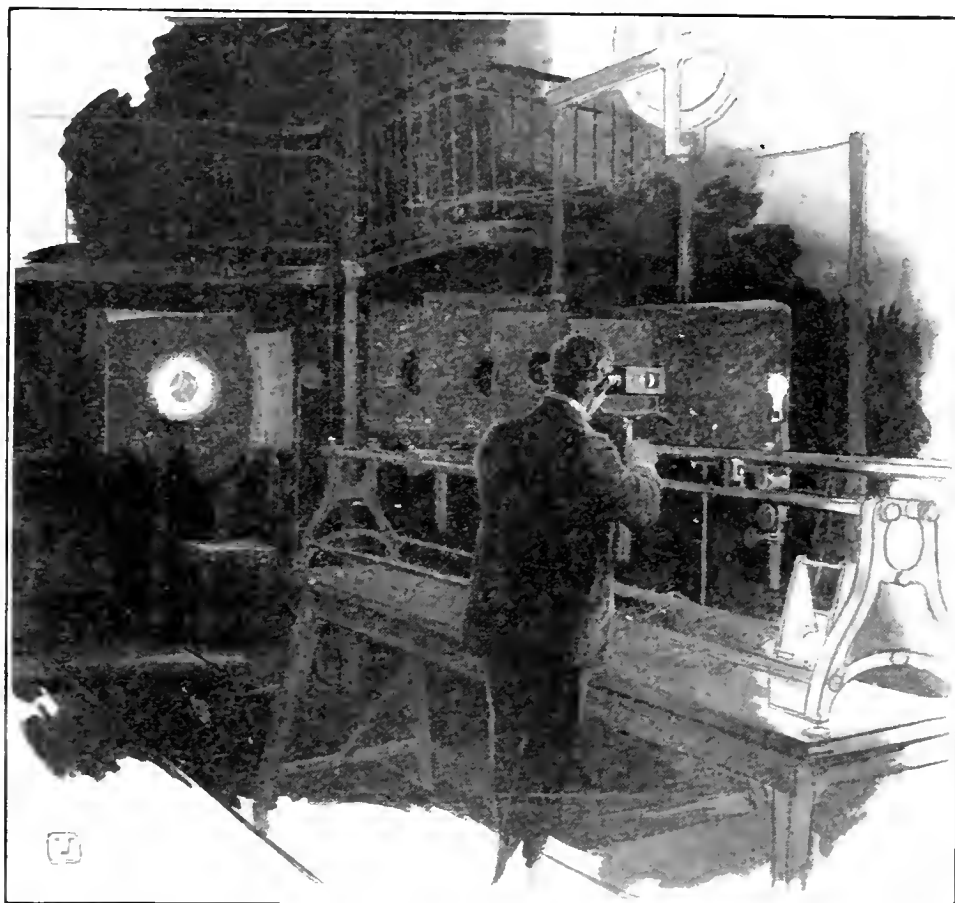
Testing Thermometers

in careful and accurate comparisons of thermometers submitted for examination with two or more standard thermometers, the observations being calculated by an assistant. When the comparisons are finally made, the letters P. T. R. (Physikalisch Technischer Reichsanstalt) with the number of the instrument is etched

on the glass, and a certificate is provided giving the corrections necessary to make accurate readings. All this is done for a fee of from 60 pfennigs to one mark (14 to 24 cents) for each thermometer, — merely a nominal charge compared with the value of the instruments. As a result of this certification and the prestige which it has given to German instruments for heat-measurement, the annual export of physician's thermometers from Germany has increased more than threefold since the Reichsanstalt was organized. It is significant that the certificates furnished with the thermometers are printed in nine different languages, — certainly an evidence of the world-wide influence of this almost unknown German institution.

Another important work of the Reichsanstalt is the effort to establish new or more accurate units of measurement. For instance, physicists say that the unit for the measurement of temperature, one degree, shall be the degree of heat required to expand a certain amount of hydrogen gas $\frac{1}{273}$ of its volume. This is as close an approximation to an absolute unit as science can make, for, having hydrogen gas and the necessary instruments, the unit can always be obtained. But in measuring light there is no such satisfactory scientific method of measurement, and Professor Lummer has been engaged in trying to establish one. His experiments are as interesting to the scientist as they are complex to the layman. Briefly, he has attempted

to measure the heat radiated by one square centimeter of pure platinum, — platinum being the most nearly perfect metal, — when heated just to the melting-point. But platinum is a very hard metal to melt, and when it does reach the melting-point, it is still



Measuring the Candle-Power of Electric Lamps

more difficult to measure its radiation. As yet, therefore, the question is unsolved.

The second department, on the other hand, has so improved the existing means of measuring light that its work is accepted the world over. As I have already mentioned, our own government, through its war

department, has submitted electric lamps to be tested here and American manufacturers have repeatedly had standard lamps sent from the Reichsanstalt to furnish a basis of measurement for their own product. Indirectly, therefore, the Reichsanstalt assures the accuracy of the candle-power on many incandescent lamps as they come from the American dealer.

The old way of measuring light was to compare it with an actual candle of a certain size made of certain fixed materials. At best this process was exceedingly uncertain, as any one may conjecture who has seen a candle puffed about by every wave of air. So Hefner, a German scientist, invented a lamp having a certain kind of wick and burning amylacetate. When the flame was 40 millimeters high it was said to equal one candle-power. The Hefner lamp, being the most accurate standard now at the disposal of scientists, is the present standard of measurement; but the Reichsanstalt, finding that the burning of this lamp was uncertain and likely to be affected by drafts, devised a small electric lamp of exactly the same power. This, with proper control of the electrical current, burns steadily and continuously, — a nearly perfect unit for measurements. To the Reichsanstalt also the manufacturers may send their lamps to ascertain at what strength of current they will burn longest, and at the same time give the most light, to see what kind of filaments are best, and so on, — all facts of great prac-

tical importance if the manufacturer would make his wares perfect.

In this connection Professor Lummer has made a series of determinations of the cost per candle-power of the various kinds of light in common use (see table on following page). The results obtained are of great practical and economic value, inasmuch as every one is a light-user. Here are his determinations, the unit candle-power being the Hefner lamp.

When the price of materials or energy is cheaper or dearer than indicated in the table, the price per hour for candle-power would of course be cheaper or dearer.

Another series of inquiries, while having great practical value, leads the way to the solution of some of the deepest and most interesting problems of science. These are experiments in the conductivity of heat and electricity by various metals. In the first place the Reichsanstalt secured rods of the metals which by chemical and other methods had been wrought to a condition approximating absolute purity. I saw these rods of gold, platinum, silver, and so on, — the purest metals, probably, in the world. They were cylindrical in shape, about three-quarters of an inch in diameter and over a foot long. They will probably long remain the standard of purity. Beginning with these pure metals, the experimenters sought to learn all they could about the effect of heat and

Kind of Light.	Price of Materials or Energy consumed.	Intensity in Candle-Power.	Amount of Material or Energy consumed per Hour of one Hefner Unit.	Price per Hour of Candle-Power.
Incandescent or Welsbach gas- light	\$1.25 per 1,000 cubic feet.	30-60	0.06 cubic feet.	0.008 cents.
Arc light (with- out globe) . . .	.15 per kilo- watt-hour.	} 200-100,000	1 watt-hour.	0.015 cents.
Petroleum . . .	.07 per quart.		.003 quart.	0.021 cents.
Arc light (with globe) . . . . .	.15 per kilo- watt-hour.	} 200-100,000	1.7 watt-hours.	0.026 cents.
Gaslight (Argand burner)	1.25 per 1,000 cubic feet.		.35 cubic feet.	0.045 cents.
Acetylene gas . .	{ 12.50 per 1,000 cubic feet.	2-50	.04 cubic feet.	0.050 cents.
Incandescent elec- tric light		} 10-500	4 watt-hours.	0.060 cents.
Gaslight (fishtail burner)	1.25 per 1,000 cubic feet.		.57 cubic feet.	0.070 cents.

electricity upon them, measuring more exactly than ever before the expansion of the rods at various temperatures, as well as their conductivity to electricity. These facts are of great practical value, but the experimenter goes further with his inquiries. He wants to know *how* the electricity passes through the metal, whether it slips around the molecules in the ether, or whether it jumps from molecule to molecule, or whether it does something else now quite unimagined. He knows much about how electricity passes through liquids by those wonderful little wanderers which science names eons, and he knows something about its passage through the gases. Indeed, President Kohlrausch of the Reichsanstalt has spent years of his life and has added much to scientific knowledge by his discoveries as to how electricity makes its way through various liquids. But physics has not the faintest inkling yet as to the reason why electricity shoots instantly through a copper wire and passes not at all through a porcelain plate. If once the reasons for all these things can be discovered, perhaps that greater question, "What is electricity?" may be answered. So the experimenters are making every possible investigation as to the properties of metals. From the data thus obtained, mathematical curves of expansion and electrical conductivity are platted, and curiously enough these curves are often found to take the form of a parabola, — just such shape as the orbit of the comets

in heavenly space. When the results in any particular metal indicate the symmetry of this curve, then a law of expansion of thermo-electrical properties or of resistance may be laid down. But some metals, like iron, nickel, and palladium, show astonishing breaks in the curves of expansion and electrical conductivity, and it is these breaks that interest the scientist most keenly, for such irregularities may furnish the master mind with the key to all the mystery. Much might be said of the wonderful speculations which all this work inspires; but such digression must, perforce, be omitted to give place to those things to which the Reichsanstalt has already given scientific solidity.

And one of these things is the tuning fork, the work with which furnishes one of the most interesting stories of the Reichsanstalt. Dr. Hagen tells it well. Musical pitch has a curious tendency to creep up. It is said that Bach's music sounds very differently now from what it did when Bach wrote it, because the instruments are now pitched higher. In 1882 it was found that the pitch of high A at the Vienna court opera had crept from the prescribed 435 double vibrations a second to 443, and in 1885 this number had further increased to 450. Accordingly, a musical conference was held and a resolution was taken to re-establish the old pitch of 435 vibrations per second. Upon this announcement the Reichsanstalt set up standard instruments, and has since tested and corrected

many hundreds of tuning forks, shortening them if they are too low in pitch, and thinning the arms if they are too high. All the military orchestras of Germany are pitched alike, and the Reichsanstalt keeps the tuning forks correct. And this solicitous care of the government in preserving standards is one of the lesser reasons why the world now goes to Germany in matters musical.

In the same manner the Reichsanstalt has established the standard and become the final authority for the measurement of all kinds of electrical currents, both strong and weak, and of electrical measuring meters, dynamos, and other electrical devices as well. A whole laboratory with a cumulative-cell battery producing a current of 12,000 volts is devoted to testing electrical insulators of every sort. While I was there the experimenters were testing various so-called insulating varnishes. Then it has standard instruments for determining the purity of sugar, for measuring the accuracy of lenses of any size, for testing safety-valve caps, and for making magnetic determinations. It has manometers, the greatest in the world, for measuring atmospheric pressures, bolometers for measuring heat radiation, apparatus for testing glass to determine what receptacles are best for holding the various sorts of chemicals, pachymeters for measuring diameters very accurately, mechanisms for measuring screw threads and screw

holes and other remarkable apparatus, a bare description of which would fill a volume.

There are rooms in which the experiments are so delicate that the visitor is requested to remove his keys, knife, and all other iron or steel objects from his pocket before entering; there are mechanisms for balancing delicate galvanometers and other apparatus so that they will not be disturbed by the banging of a door or the tread of feet, although it seems impossible that any commotion, however great, should jar these solid buildings. You see scales which weigh in water, — the famous water balance of von Helmholtz, — and near at hand are the most delicate scales in the world, the weights being all of aluminum, the largest weight being one gram, or about a quarter of the weight of a copper penny. On these scales, which are enclosed in an air-tight case, you may accurately weigh a hair from your eyelash.

Discoveries of value are made in these rooms, devices are invented which, if patented, might yield the inventor a fortune; but everything is free to science. In Germany the highest science offers what it finds for science' sake. That is one of many reasons why Professor Röntgen, who might have made his fortune from the world-benefiting discovery of X-rays, is so highly esteemed in Germany to-day.

I think I have said enough of this astonishing institution to show its scope and its profound influence not only in science, but in the practical business affairs of the nation which has given it life. It bears a part in the commercial race for supremacy in which Germany is now engaging so lustily. England, not slow to see its advantages, is already making arrangements for the establishment at Kew of a similar institution. A committee of English scientists has recently made several visits to Berlin, where its members were accorded every opportunity for seeing the Reichsanstalt and for studying its methods. But as yet Americans are apparently unaroused to the importance of such an institution,¹ although through the influence of several advanced American scientists the government has obtained some particulars as to the work of the Reichsanstalt. The United States government has not the resources nor the scientific interests of the German empire; but the public spirit of American citizens, developed, perhaps, by this lack of parental care on the part of the governing power, have been founding universities and libraries on a scale without parallel. May not some of them feel the need of such a scientific establishment as the Reichsanstalt?

¹ Cornell University has a department in which many experiments along the lines pursued by the Reichsanstalt have been made.

VII

HOW THE GERMANS CREATED A NEW INDUSTRY

VII

HOW THE GERMANS CREATED A NEW INDUSTRY

The Glass and Lens Manufactories of Jena

THE quaint old city of Jena, in the German Grand Duchy of Saxe-Weimar, is chiefly famous for three things. It has an unfading claim on history because Napoleon once marched through its streets and won a celebrated victory on the hills to the north, — the battle of Jena, — and in the present it is known the world over for its university and for its glass and lenses. There are glass works, if not lens manufactories, of far greater extent in America and in other parts of the world than these of Jena; and yet Jena glass and Jena lenses have their own unique claims to distinction, especially among scientists. Not only in their processes of manufacture, and in the perfection of their products, are these works famous; but the management of their business affairs furnishes a most unique and fascinating study in social economy, for here the dream of an idealist has been given unique and wonderfully practical application, with the result that the workingmen

of Jena have opportunities and rewards unequalled, perhaps, anywhere else in the world. And, curiously enough, owing to the modesty of the originator of this scheme for the elevation of the workingman, and for



Making Crucibles

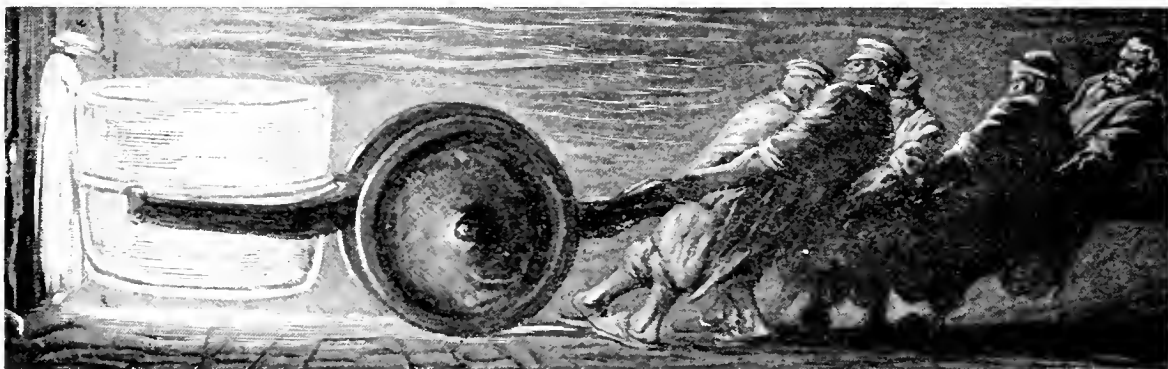
the advancement of science, very little has ever been published about it, and until now nothing in English, so far as I can learn. With German conservatism, Professor Abbe has desired to give his experiment the test of years before recommending it by a formally pub-

lished account. In the next chapter I shall speak further of Professor Abbe's remarkable philanthropy.

For many reasons it is not probable that such institutions as these — for in reality they partake as much of the character of public institutions as of regular business enterprises — could have originated in America. They would seem to be a product typically German, — a result in part of what may be called the German scientific temperament and in part of the wave of commercial expansion now sweeping over Germany. Many years ago Professor Abbe, who then, as now, filled the chair of applied mathematics, natural philosophy, and astronomy in the University of Jena, became deeply interested in lenses and lens-making. He had seen the defects of the lenses in use for astronomical and microscopical researches, and he set himself to establish by purely mathematical calculation the exact curves at which lenses would give the greatest possible effect with regard to the refraction and dispersion of the light which passed through them. In other words, he sought to form a new and scientific theory for making lenses. He then interested himself in the modest lens works of Carl Zeiss of Jena, and here he had lenses made according to exact scientific methods. Before his time lens-making was largely a matter of experience and experiment on the part of highly skilled workmen. Professor Abbe suc-

ceeded in laying down exact mathematical formulæ, so that when a lens was ground with sufficient exactness to the rules of the measurement it must of necessity be correct.

But it was not long before Professor Abbe dis-



Removing the Crucible from the Furnace

covered that there was the greatest inequality in the glass which he was compelled to use in his lenses, that the power of refraction and dispersion of light varied widely with every melting, and he conceived the idea that if exact chemical formulæ could be established for glass-making, and that if new kinds of glass could be produced by the use of other and hitherto untried substances, important new results might be obtained. In other words, a complete revolution in glass-making was necessary, in order to accomplish the great results at which he was aiming. The task seemed to be insurmountable, but it did not daunt him. His first step was to interest Dr. Schott of Witten in the work. Dr. Schott was not only a thorough scientist, especially in chemistry, but he possessed

a technical knowledge of glass-making, as it was then conducted. In 1881, the first smelting experiments were made in a small laboratory erected for that purpose. There was a deliberate plan on the part of the two scientists to solve by scientific methods the difficult problems of glass-making, though they involved not only the most advanced optical research, but the most difficult chemical and technical manipulations, and Professor Abbe had clearly in view the possible establishment of a business enterprise based on the discoveries which he hoped to make, should these be of sufficient importance.

Such an enterprise as this is certainly typically modern, and it may be significant as indicating how the great new industries of the future are to have their origin. For two years Professor Abbe and Dr. Schott worked steadily ; they tried making glass with all manner of new materials, in many hundreds of different meltings, afterwards testing with the utmost care each variety of glass to ascertain its optical properties. Almost at once they began to get promising results, and after two years they were prepared to carry on their experiments on a larger scale, but this they did not have the means to do. In America or in England the work might have failed just at this point, but in Germany help came as help rarely comes outside of Germany. Professor Abbe laid his results before the Prussian government, showed what

had been done and what needed to be done, and the wide-reaching effect which favorable results might have in every department of science, — the possibility of making microscopes, telescopes, and photographic lenses of hitherto unequaled definition and power, and of producing thermometer and barometer glass which might advance the science of temperature and pressure determination. The government at once felt the commercial appeal. Germany must needs buy all of her glass for scientific purposes in Paris or in Manchester, and here was an opportunity of building up a new industry which would employ German workmen and bring money into Germany. So the Prussian government appropriated 10,000 marks (\$2,500) in 1883 and again in 1884 to have the experiments carried forward. At the end of that time so successful were the investigators that a regular glass-making establishment was well under way and there was no further need of government assistance. In four years' time these glass works furnished a large proportion of the fine scientific and optical glass used in Germany, and now their wares are known everywhere in the world, — in the form of microscope and photographic lenses and prisms, in thermometers, in chemical apparatus, and in the highest grades of commercial glass. This little story is especially interesting as showing why Germany is making such extraordinary strides in commercial affairs. Out of



Pouring Molten Glass into Lens Mould

Science, assisted by the state, has sprung a new and profitable industry.

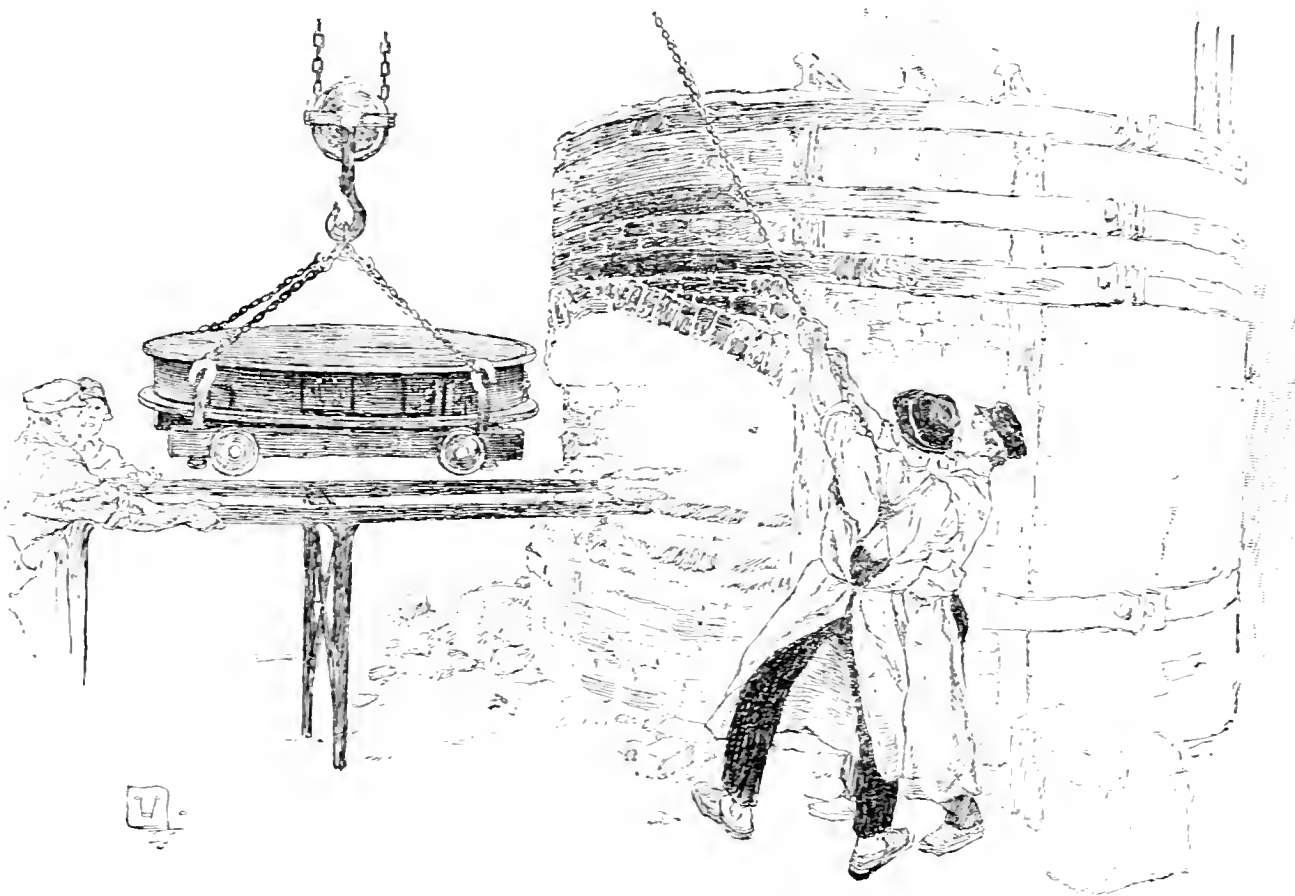
In all over one hundred new kinds of glass were originated and are now manufactured at the Jena glass-works. In former times glass was composed almost entirely of the silicates, potassium, lead, soda, and lime, and there were, roughly speaking, only two varieties: the old-fashioned standard crown glass and flint glass. Professor Abbe and Dr. Schott used no fewer than twenty-eight new substances in glass-making: phosphorus, borax, magnesium, zinc, cadmium, bismuth, iron, mercury, antimony, tin, and others. Each of these substances had its own peculiar effect on the refraction and dispersion of light, and in doing away with or lessening what is known as the secondary spectrum. Much of the glass thus produced has been ground into lenses at the Carl-Zeiss Works, and the microscopes which resulted gave a new impetus to every department of science which has to do with minute forms of matter or of life. It would have been impossible for Dr. Koch and other great contemporary investigators in bacteriology, for instance, to have made the astonishing additions to our knowledge of the life of microbes and bacteria, had not Professor Abbe first produced a perfect or nearly perfect instrument for examining these low forms of life. In many of their published reports Dr. Koch as well as others give Professor

Abbe a large share of the credit for these profoundly important discoveries in connection with the germ theory. In the same way the Jena microscopes have done wonders in the hands of such men as Haeckel in laying bare the wonderful life processes of the lowest forms of plant and animal existence, in tracing the development of each, and in forming the great chain of proof of the theory of evolution. Much of our present minute knowledge of embryology and the growing mastery of the details of that marvellous machine, the human body, is due to the efforts of that modest, hard-working professor of Jena.

The achievement of the investigators lay not so much in producing microscope and telescope lenses of higher magnifying power, — that service science did not need, — but in so perfecting the lenses that the image would be clear and clean cut, or, in the words of science, “in securing perfect definition.” A microscope which magnifies 4000 times and produces such a blurred image of a cell that the investigator cannot tell whether or not it contains a nucleus is not as valuable to science as one that magnifies 500 times and brings out every minute detail distinctly and sharply. And that is also just the distinction between a good and a poor photographic or telescopic lens. Professor Abbe also introduced the system of oil immersion and other great microscopic improve-

ments. Indeed, he may be justly called the “father of the modern microscope.”

From the investigations begun thus in a laboratory by Professor Abbe and Dr. Schott, have sprung two great manufacturing plants, separate and yet allied,



Putting Crucible into Cooling Furnace

neither of which is able to keep up with the present demand for its product. We visited the Schott Works on the hill above Jena, where all the new varieties of glass are made, and afterwards, at the Carl-Zeiss Optical Works, we saw this glass ground and polished with infinite care and precision into lenses and prisms.

Both of these business institutions, founded on scientific investigation, still continue their scientific work. The lens manufactory has no fewer than twenty scientists on its staff, and the glass works has five, all thoroughly schooled investigators and mostly university doctors. These men devote their entire time and attention to experimenting along chemical, optical, mathematical, and technical lines, seeking to discover new processes and establish new principles which will be of value in the business. In this way the whole institution is kept on a thoroughly scientific basis and in the foremost van of progress. This idea of a scientific staff for a business institution has its most perfect development in Germany. Indeed, science lies at the root of some of the most progressive and profitable business enterprises in the empire. It is an expensive adjunct, — too expensive for practical work, think many American and English manufacturers, — but these men of business in Germany have shown how richly it pays back profits. The history of the utilization of coal-tar products in Germany makes one of the most romantic stories of science and business; the development of electro-technics makes another.

The lens manufactory, especially, has its own unique methods of doing business. A large telescope is looked upon as an artist would look upon his newest picture. It must be as perfect as it can be

made, time and cost of materials notwithstanding, and when it is finished it is billed on the basis of its cost. Cheap instruments are made to provide



Sealing up Cooling Furnace

work and training for the younger and less experienced workmen. And yet so great is the demand for the fine products of the factory that they cannot be supplied. Curiously enough, also, no patents are taken on instruments and processes, like microscopes

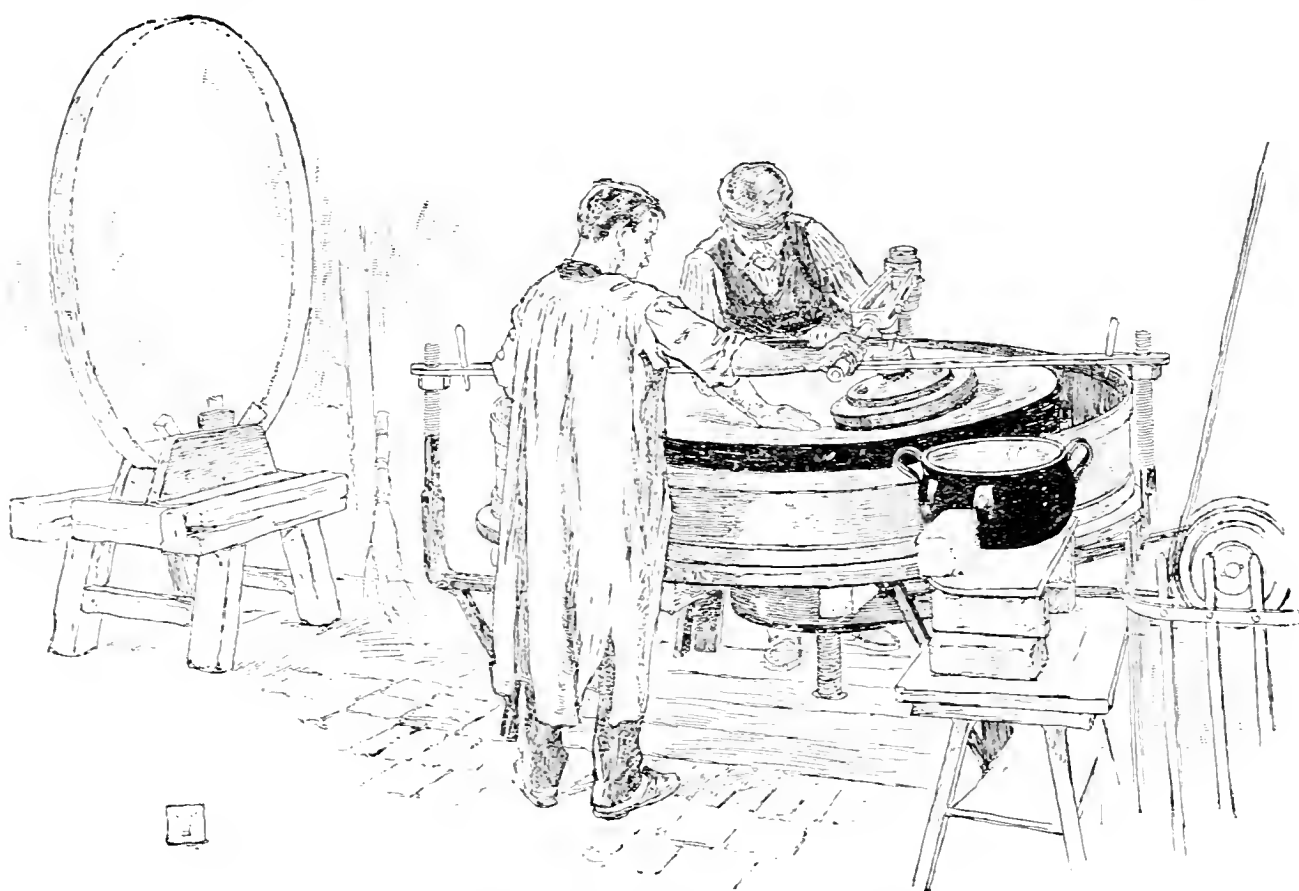
and microscopic attachments, which are used solely for the advancement of science, the men behind this unique institution having their hearts too deeply set on the advancement of human knowledge to hinder it by monopolies. The product of high-grade microscopes alone at this factory is over 1,800 a year, and each microscope comprises the work in some detail of over fifty men.

In order to give a clear idea of the work of these two great institutions, it may be well to describe the operation of casting a great lens, as I saw it in the glass works of Jena.

At the time of my visit it had just turned afternoon in the furnace-house of the glass works.

For upwards of two hours everything had been in readiness for the casting of the great lens, everything except the glass. The master had directed the placing of the huge circular iron mould near the open doorway and just between the two furnaces, — the one from which now burst the fervid white radiance of the molten glass, and the one in which through weeks of lessening heat the lens, when cast, was to be cooled and toughened and tempered. The mould was a meter and a quarter in diameter, — over four feet, — and the lens here to be cast would make one of the largest in the world, large enough to bring the moon within a few hundred miles of the earth, and one so perfect, perhaps, as to surprise new secrets

from the sun itself. The master had sprinkled the bottom of the mould with fine sand from a curious tin pot, that the hot glass might not take up impurities from the iron. A dozen brawny workmen, in blue blouses and wooden-soled shoes, had come in to man the long, wheel-mounted tongs which were to drag



Polishing a Great Telescope Lens

the crucible from the furnace bed. Other workmen with sledges and bars had torn a gaping hole in the front of the cooling furnace so that it would be ready for the instant admission of the lens. “Cooling furnace” seemed an odd misnomer, for a great jet of burning gas had been spouting into this tower-

like brick house for about two days, and as the workmen tore away its sides great stones, two feet thick, were seen to be white hot halfway through, and the workmen, experienced though they were, must needs step quickly to avoid the fierce outward burst of heat. At first the interior of this furnace, as seen through its gaping mouth, was without detail, — a glowing, white-hot hole of a brilliance that dazzled the eyes, — but as the cold air rushed in, the lips added color, apparently in waves, a faint wavering pink, followed by bloody red. Then, with another burst of heat, all definition would again blur to white, but only for an instant. With more cold air the colorings would return, each time in quicker succession, and each time the red showed deeper and darker and lasted longer. And finally one could distinguish plainly the flat stone floor of the furnace, where the lens was to rest, with the surrounding circular walls and the domelike top.

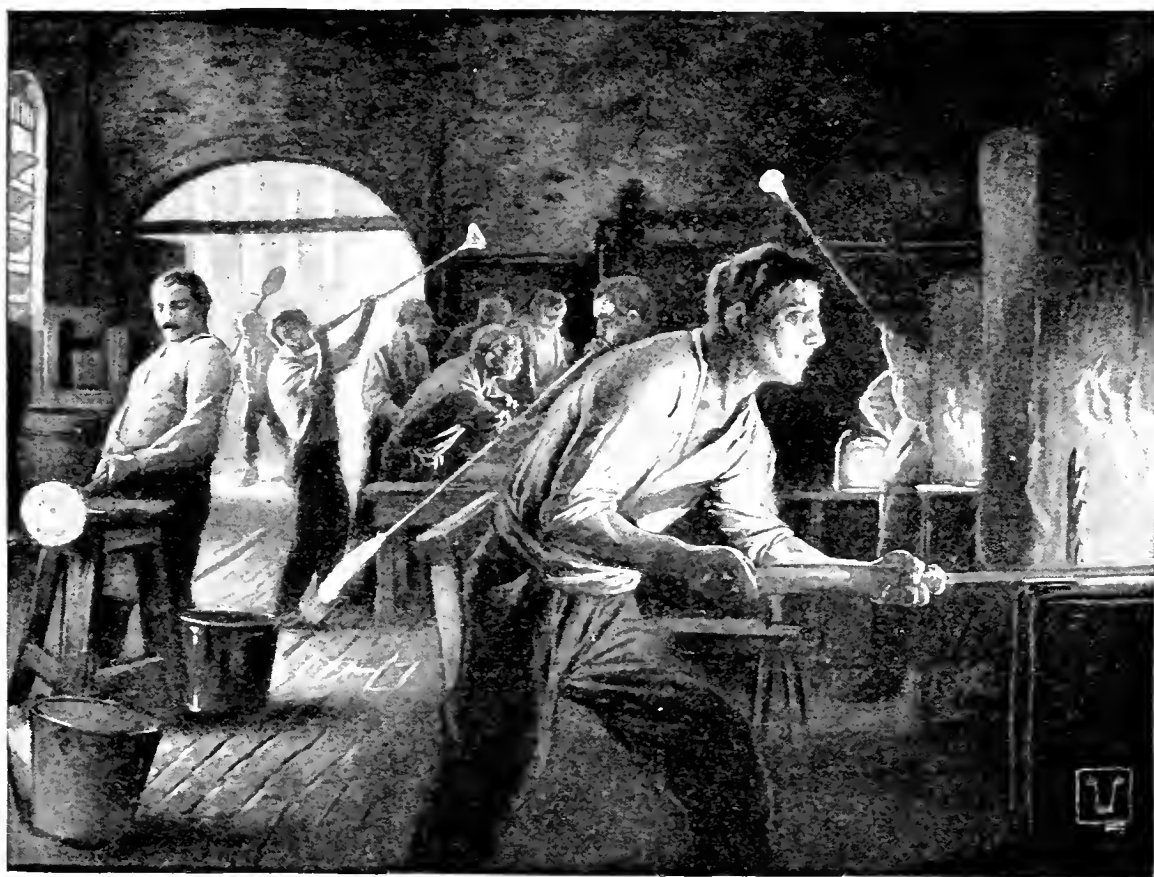
So everything was ready. The master, shading his face with his upraised arm, peered into the “glory” hole of the melting furnace, as he had been doing with ever greater frequency for hours past. He watched for a moment the shimmering, wrinkled surface of the molten glass within the crucible and then he followed the movements of the stirring lever. Was the color exactly right? Did the sluggish waves which followed the stirring plunger show thick or thin enough?

Twenty-four hours this crucible had been heating within the furnace, melting together the various silicates, borates, and other minerals which the chemists had so carefully analyzed and measured and weighed. For twenty hours of that time a workman, standing at the end of a twenty-foot lever, the handle of which was kept cool by running water, had been slowly stirring the mass, so that the mixture would show neither veins nor striæ nor bubbles, so that the light of some distant star might in the future pass through it to the eye of the interpreting astronomer without loss or change of color. To obtain this perfect glass there had been years of experimenting to discover the best combinations of glass-making materials; there had been many failures because the crucible was not properly made, because the furnace was not heated evenly, because the molten glass was stirred so rapidly as to produce bubbles or so slowly as to leave seams, because the proper fluidity was not attained before the pouring, or because overheating had given the glass a bluish tinge when it should be water clear. Experience soon shows how to blow a perfect lamp chimney, and a thousand can be made in succession without a defect, but a great telescope lens is not made every day. It is the final and greatest triumph of the glass-maker. And thus it was that the master peered often and anxiously into the glory hole of the melting furnace.

At last the time came. The master gave the word, and a dozen men sprang forward with hooks and bars. The glory hole was hardly larger than a man's head,—just sufficient for the passage of the stirring lever and to permit examination. With this as a beginning, the workmen tore out the whole front of the furnace, working with the utmost activity, their heelless shoes clattering on the stone floor as they rushed back and forth. The stirring lever was dismantled, and the stirring plunger itself, white hot and sparkling with the dust that fell upon it, was cast outside where it lay, a deep wine red in the sunshine. Though made of the most infusible fire clay, the lower end of this plunger was eaten away and melted out like a half-burned stick of wood, giving convincing evidence of the terrific heat of the furnace.

The grappling tongs were thick bars of steel about thirty feet long, mounted on iron wheels. As soon as the furnace was open, the grappling ends were thrust inside, one on each side of the crucible, the men at the other end leaning back with heads averted to avoid the fervid outburst of heat. As the clay crucible stood there with the white-hot walls around it and the shimmering, liquid glass within, it seemed so lacking in clear-cut outline, so soft and immaterial,—like a bit of impressionism,—that one scarcely believed it could be wrenched from its place in the picture by anything so cold and hard as the steel tongs.

Although the novice could not see it for the brightness of the glow, there was a thick ridge around the crucible, about half-way up. Under this the tongs fitted themselves. The men at the other end bore down hard, but the crucible did not stir. It was firmly fastened to the furnace floor by the



In the Jena Glass Works. Blowing Chemical Glass

glass that had spilled in the melting. It was an anxious moment. Crucibles have been broken in lifting. The master raised his hand. Slowly the men added their weight at the far end of the lever. The crucible broke suddenly free, jogging a little, so that a bit of the glass overflowed and ran down like

thick syrup. An instant later the crucible was outside the furnace, filling the whole of the high, dim room with heat and light, like a new sun. And thus it was pushed down the room toward the mould, a thing of exquisite beauty and yet of terror, showing a hundred evanescent colors, changing red, pink, yellow, violet, and when one turned his eyes away, green, in every dark corner of the room. All the faces of the men glowed with it, and it seemed to throw their bodies in high relief against the thick darkness behind.

The crucible was lowered to the floor, the tongs were removed, and a workman cast a board of asbestos over the glass to prevent too rapid cooling. Here it stood a few minutes, and when the crucible began to define itself, one discovered that it was made of fine yellow-glazed pottery. Imperfections on its surface stood out like specks on a mirror, or as one would imagine the spots on the sun.

It had required a day for a man to fashion the clay of this crucible, and many weeks for it to dry. Before being used, the crucible had gradually been heated for several days, so as to stand the high temperature when brought into the furnace.

Three men with thickly gloved hands are now fastening an iron band around the crucible just under the ridge. On each side of this band there is a protruding pivot of steel which fits into a socket in the

ends of the grappling tongs, thus permitting the crucible to be tipped up as if on an axle. Again the men rest their weight on the other end of the tongs, the crucible is lifted, and an instant later it is poised over the iron mould. The critical point of all this labor has at last been reached. There is a pause as if the workmen felt the anxiety of the moment. The foreman, with his hand ready on the tilting lever, awaits the master's word. There is a shout, a quick upward swing of the foreman's arm, and out from the crucible slips the molten glass. It has been a moment of so much stress that one anticipates a crash as the glass touches the cool iron of the mould, but there is absolute silence, not so much as a hiss or the sound of the splash. There is something indescribable about the fluidity of this mass. It seems thick, like oil, and yet it spreads swifter than water: it is more like quicksilver than anything else that one can think of, — and yet not at all like quicksilver.

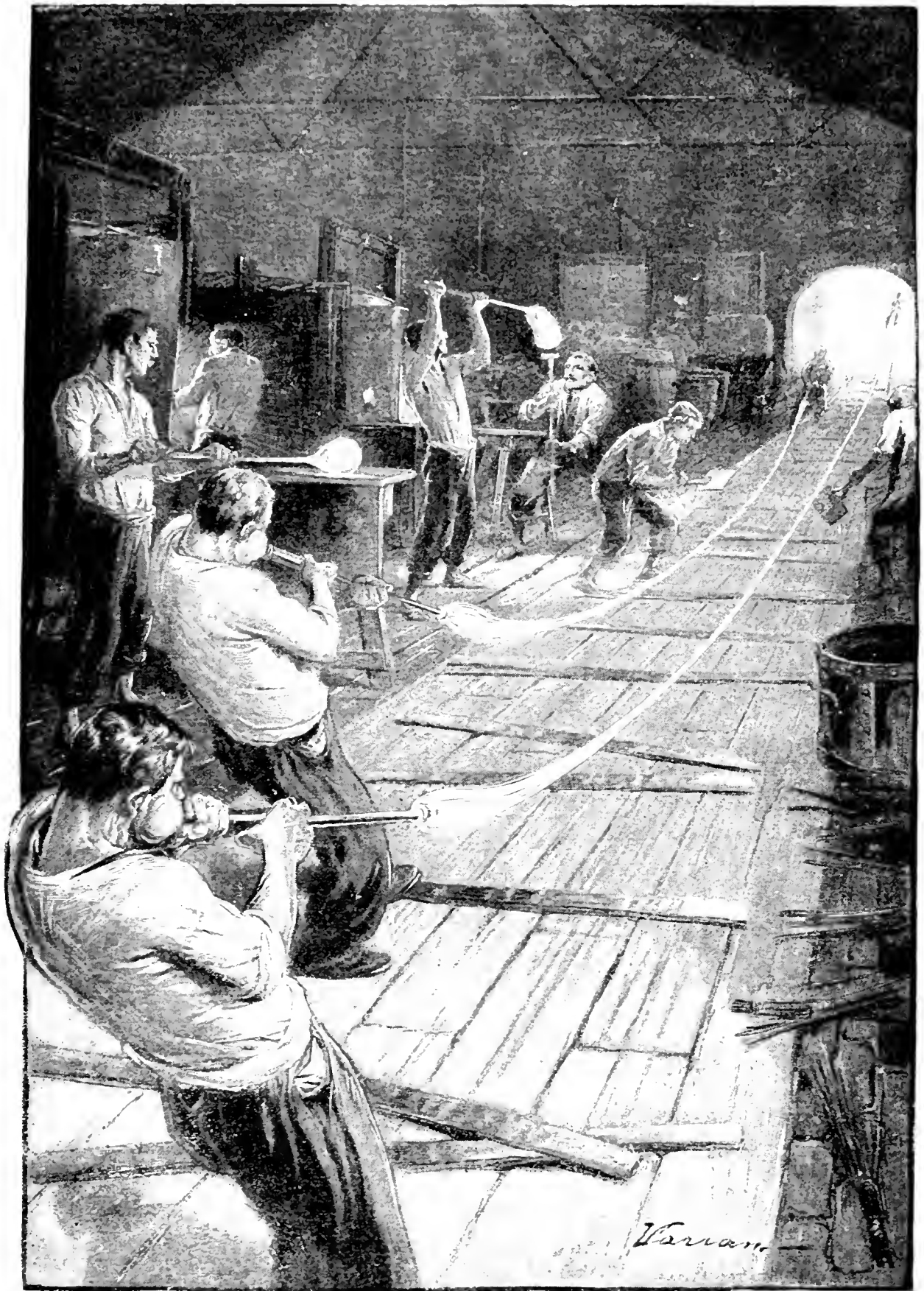
As the foreman pulls back the lever, molten glass drips from the edge of the crucible and sends up thick smoke as it burns the dust on the floor. A moment later this spilled glass begins snapping and cracking with almost explosive violence, the outside cooling so much more rapidly than the inside. And this is what would happen to the lens itself if it were not placed in a furnace where the heat could be

reduced gradually through many days or weeks. I picked up one of the bits of glass thus broken off. As I held it up to the light it gave no evidence of color, or bubble, or seam ; it was indeed so clear and clean and transparent that if it were not for the defining edges one might well doubt whether he had anything at all in his hand.

The mould with the glowing lens inside was now covered with a plate of iron, wheeled to the mouth of the cooling furnace and lifted with chain tackle to the height of the furnace floor. A movable frame tramway was then placed underneath it, and it was quickly pushed into the furnace. Workmen were ready with brick and mortar, and in ten minutes the lens was walled in. Here it is cooled for two weeks and then brought again to the open air, dull and milky of surface and possessing only the general shape of a lens. After that for days and weeks workmen are employed in polishing it, not to give it the final form which it will have in the great telescope, but merely to prepare it for that important and anxious day when it will be submitted to those searching tests for imperfections, during which it must pass even the close scrutiny of microscopic and spectroscopic examination. A few bubbles it may have and pass, for bubbles have no effect except to reduce the passage of light in a minute degree, but veins, denoting the improper mixture of the ingredi-

ents of the glass, it must not have. If it passes all the tests, and sometimes it requires many castings and costs many rejected lenses of this most precious glass before the necessary perfection is attained, it is again sent to the furnace house, where with even greater care than before it is slowly raised to a high temperature, and thus annealed, and then as slowly cooled for many (eight to ten) weeks. After that it is ready for the lens-maker proper, that skilled mechanic and mathematician of Jena or of America or France, who polishes down its sides with infinite care, until they reach the required curves. Each of these processes has absorbed precious time and has cost much money: the bare glass for such a lens would cost not less than about \$5,000. To this the skill of the optician would add in polishing fully \$20,000 more, so that the finished lens, ready for fitting into the telescope tube, would represent an expenditure of over \$25,000. Through such pains and expense as this must science pass that mankind may add a few facts to its knowledge of some distant star.

The German workmen are standing back from the cooling furnace, perspiring, the lens finally cast. A boy comes in with his apron full of beer, a bottle for each, and they drink in characteristic German fashion to the success of the work. It may be many a day before such another lens is made.



*Blowing and Drawing Thermometer Tubes — the Most Perfect
in the World*

Thus a great telescope lens is made. The manufacture of optical glass for microscope lenses is a similar though less spectacular process.

The constituents of the glass are mixed with great care under the supervision of expert chemists, then the heating and stirring goes forward for several days until the glass is hardly thicker than water and thoroughly mixed. After that it is taken from the furnace and allowed to cool in the crucible. Of course it cracks into hundreds of pieces, some large and some small. These pieces are carefully assorted and all the imperfections chipped off. I saw two men, their eyes protected by goggles, employed with hammers at this work. It is interesting, and significant of the care required in these processes, that in spite of experience and the closest attention, more than one fifth of all the glass melted is regularly rejected, owing to imperfections. These pieces of glass are now placed in a square clay mould or *chamotte* of just the size that the future rough lens block is to be. Then it is set aside in the furnace, where for a month or six weeks it is slowly heated until the glass softens down and fills the mould, then it is as slowly cooled. The lens comes out looking like a rough block of sanded glass. The polishers now rub down two of the sides until they are perfectly clear and bright, so that one may look straight through the block and make the closest examination for flaws. The best of this glass

is as beautifully clear as a jewel. There are a great variety of shades from purest white to the deep yellow of the heavy lead glasses, the prices of some of the glass reaching as much as \$20 a pound. At the lens manufactory this glass is ground into lenses and prisms of every conceivable size and form, some lenses being not larger than a pin-head and as costly almost as a diamond of the same weight. Great skill is required in this work, because an error of more than one ten-thousandth of a millimeter in the curve of a lens makes it unsuitable for use in the highest grade of instruments.

Another picturesque feature of the glass works is the great corridor where the thermometer tubes are blown and drawn. In the chapter of this book entitled "A Typical Scientific Institution," I described in what a wonderful way the German Empire, through its Reichsanstalt, has set the world's standards for accurate measurement of heat, light, and electricity. In the early days of its work the Reichsanstalt (then the Normal-Aichungs-Kommission) joined with Professor Abbe and Dr. Schott in trying to produce more perfect glass for use in making thermometers, the glass formerly used being subject to the influence of heat and cold. The result has brought all the world to Germany for high-grade scientific thermometers.

We saw this glass in process of manufacture. A

boy workman caught a bit of molten glass from the furnace on the end of a blow-pipe. It was hardly larger than a walnut, but by twirling and blowing and moulding, it grew to the size of an orange, with the shape of an acorn. More glass was then added, and there was more rolling and blowing, and when the proper stage was reached the blow-pipe was passed quickly to the brawny master-workman. He in his turn added glass, blowing from time to time with cheeks outpuffed until it seemed as though they must burst, and then rolling the great ball of glass on his iron kneading-board until it looked like a huge yellow gourd. Faster and faster he worked, keeping the ball always symmetrical and yet white-hot. At length he lifted the glowing mass quickly in the air, and a second workman attached his blow-pipe to the bottom. Then the two men ran in opposite directions, twirling the pipes and blowing lustily from time to time. From a thick, portly yellow globe the glass thinned out quickly as the men ran apart, until it became a dull red tube not larger than a man's little finger and nearly three hundred feet long. Sometimes in drawing these tubes one of the blowers would not only run the length of the corridor, but far outside on the hill. And that is the way a thermometer tube is blown and drawn. It requires only a moment in cooling, and then it is broken up into short lengths and sent to the ovens for

tempering and annealing. In these rooms also are blown the finest glass for chemical apparatus, for incandescent gaslight chimneys (30,000 of these per day), and for other purposes requiring high-grade glass.

VIII

A GERMAN VENTURE IN PRACTICAL PHILANTHROPY

VIII

A GERMAN VENTURE IN PRACTICAL PHILANTHROPY

Professor Abbe and his Profit-Sharing System

WITHIN the next few years the world, particularly that part of it which is engaged in the task of bettering the condition of the wage-earner, is destined to hear much of the extraordinary experiments in practical philanthropy carried on by Professor Abbe of Jena. In the preceding chapter I have given some account of the glass and lens works of Jena, and how they were created in typical German fashion through the remarkable scientific experiments of Professor Abbe and Dr. Schott. These manufactories, though conducted on thorough business principles and yielding large profits, partake more of the nature of public institutions than of enterprises for private gain; they indicate perhaps what may be the future condition of all great business enterprises.

Professor Abbe lives just across the street from the huge buildings of the lens manufactory. His

home is a little one-and-a-half story building, old-fashioned and German-like. It is thickly surrounded with trees and shrubs and laid out with flower beds. At the time I saw it the lilacs were in full bloom, and the fragrance drifting across the street filled the rooms where the glass polishers bent low to their work.



Professor Abbe

Here Professor Abbe has worked year by year in his favorite fields of optics, mathematics, social economy, invention; and although now well along in years he is not lacking in his zest for new and more difficult problems. Every summer he takes a short vacation in Switzerland, where the people of the village at which he stays know him merely as "the German professor." Thus quietly he has lived, watching the

factories rise around him and win him a fortune. From the first he was deeply interested in the welfare of the workingman, — an interest hardly second to his love for science, — and out of this interest grew the Carl Zeiss Stiftung (institution) named from his friend Carl Zeiss, which now controls the entire lens manufactory with its 1,200 or more workmen, and owns a half-interest in the glass works with its 400 workmen.

The Stiftung is unique among institutions. It is the creation of a law of which Professor Abbe was the author, and it is in the nature of a corporation under state control. To this Stiftung Professor Abbe turned over all his interest in both of the great plants at Jena, retaining only a directorship. A commissioner of the Grand Duchy visits the works every week and assists the local directors in carrying out the tenets of the law. The purpose of the Stiftung is twofold. First, it provides for the comfort of the personnel of the works, from the directors to the lowest apprentice boy, by means of a unique system of pensions, sick benefits, profit-sharing, and educational advantages. Second, it provides for large contributions toward the advancement of science. No one connected with the institution receives any of the private profits of ownership. Professor Abbe himself receives merely the salary of a director, which, according to the law controlling the Stiftung, can

never be more than ten times the average salary of workmen aged more than twenty-four years and for more than three years in the service of the firm. And this class of workmen now receives less than \$500 a year. But Professor Abbe is entitled to a pension when he shall cease his active connection with the business, the same as every other employee. If it should be absolutely necessary to discharge a workman, he must not only be given due notice, but the Stiftung must pay him, if he has been employed for more than three years, a sum equal to his total wages for from six months to two years, according to the length of time he has been in the works. And after five years' service every workman who retires for age or invalidity receives a pension, or should he die, his family is pensioned. In this way he is absolutely secure in his work. The Stiftung sets aside a certain definite sum from its earnings every year, and this is so invested outside of the business that it will pay all pensions and discharge advances, thus making the pension system independent of the vicissitudes of the business, for even though the business fails, money will be on hand to pay the regular pensions of old and faithful servants. Every workman is given a two weeks' vacation every year with pay for half of it, and he is also paid in full for all holidays except Sundays. Moreover, the whole lens manufactory, with Professor Abbe at its

head, is like a great family. Every month a delegate from each of the departments, thirty in all, meet with the directors and discuss the conduct of the work. These delegates are never foremen, but represent the men themselves, and the suggestions they make are from their own point of view, not from that of the foremen. Last spring the subject of shorter hours of labor came up, a subject of which Professor Abbe and the other directors had already been thinking. The workman delegates to the conference suggested eight and one-half hours a day: the directors promptly responded, "Why not try eight hours?" Every workman was questioned, and six-sevenths of them asserted that they could do as much work in eight hours, working faster than they could in the longer day. Lens-grinding is very confining work, especially fatiguing to the eyes and even more so to the nerves. So on April 1, 1900, the experiment of an eight-hour day — a very great innovation in Germany — was begun. The hours of work were from 7 to 11.30 A. M. and from 1.30 to 5 P. M., the long noon-ing giving the men ample time to go home to dinner and to rest thoroughly for the afternoon's work. Director Fischer informed me that the plan so far as it had been tried was a great success, fully as much work being accomplished in the short day as had hitherto been accomplished in the long day; and he thought that the work was of better quality, although

the experiment had not then been in progress long enough to permit of positive assertions.

In addition to these advantages to the personnel within the works themselves, the Stiftung has spent large sums of money in other directions. I visited an extensive and highly popular free reading-room, said to be the largest institution of its kind in Germany, the Germans having always depended on the cafés for their periodical literature. A fine library building to contain a good collection of books as well as this reading-room is soon to be constructed. The Stiftung also contributes largely to the local hospitals that its workmen may be cheaply treated; it has established special courses of instruction for its men in mathematics, physics, drawing, mechanics, and in the German, English, and French languages; it has instituted a free swimming bath in the Saale River; and it is helping to build walks and summer houses along the mountain-sides and in the forests around the town, — those strolling and social spots which a German so dearly loves.

All of these advantages help to attract to the lens manufactory an unusually intelligent and productive class of workmen — and indeed for these fine operations great intelligence is required. So far as possible young men are taken and specially trained to the requirements of lens-making; and as they grow older, the cumulative advantages of the pension and profits

system, as well as the short hours, tend to keep them where they are, even though tempted elsewhere by offers of higher wages.

These are by no means all the advantages which the Stiftung offers its workingmen, but they will suffice to indicate its purposes in this direction. In its other activities, science has already felt the influence of the Stiftung. It has established and equipped a fine astronomical observatory in the University of Jena; it has founded a new chair of mathematical physics and will build a fine laboratory for experimental physics; and it is a large contributor yearly to other departments of investigation at the University of Jena, Professor Abbe still filling the chair of astronomy and natural philosophy in the University. Nor are its interests confined to Jena alone, but extend to science in general, even to the considerable assistance of a recent Polar expedition. Such activities as these — and they are as much a part of the *business* of the Stiftung as the making of glass and lenses — seem odd enough as looked upon from the exceedingly practical point of view of ordinary business life.

The Stiftung has now, 1901, been in existence ten years with great success. The profits of the business have been large, and its activities in science and in benevolence have been correspondingly large. It was the state that helped the work in the beginning by the

liberal contributions of money that enabled Professor Abbe and his associates to carry on their experiments, and now the German people, and indeed humanity in general, are reaping the reward. And in case the Stiftung should ever go out of business, for whatever reason, one-half of the proceeds remaining after the debts are paid will go to the city of Jena, to be used for the good of its inhabitants, and one-half to the University of Jena. Not a cent is reserved for private disposal.

Professor Abbe devotes most of his time to the working out of this great philanthropic idea. Anticipating at the time he drew up the law governing the Stiftung that forethought could not provide for every possible condition, he reserved to himself the right, until the year 1906, to make changes in the statute. In this way he is able to correct any errors or injustices as time and experience point them out. After 1906, however, there can be no more changes: the law will be absolute and perpetual; and as long as lenses are made at the Carl Zeiss works, so long will its workmen enjoy advantages almost without equal anywhere in the world, and so long will science have a strong and faithful ally.

IX

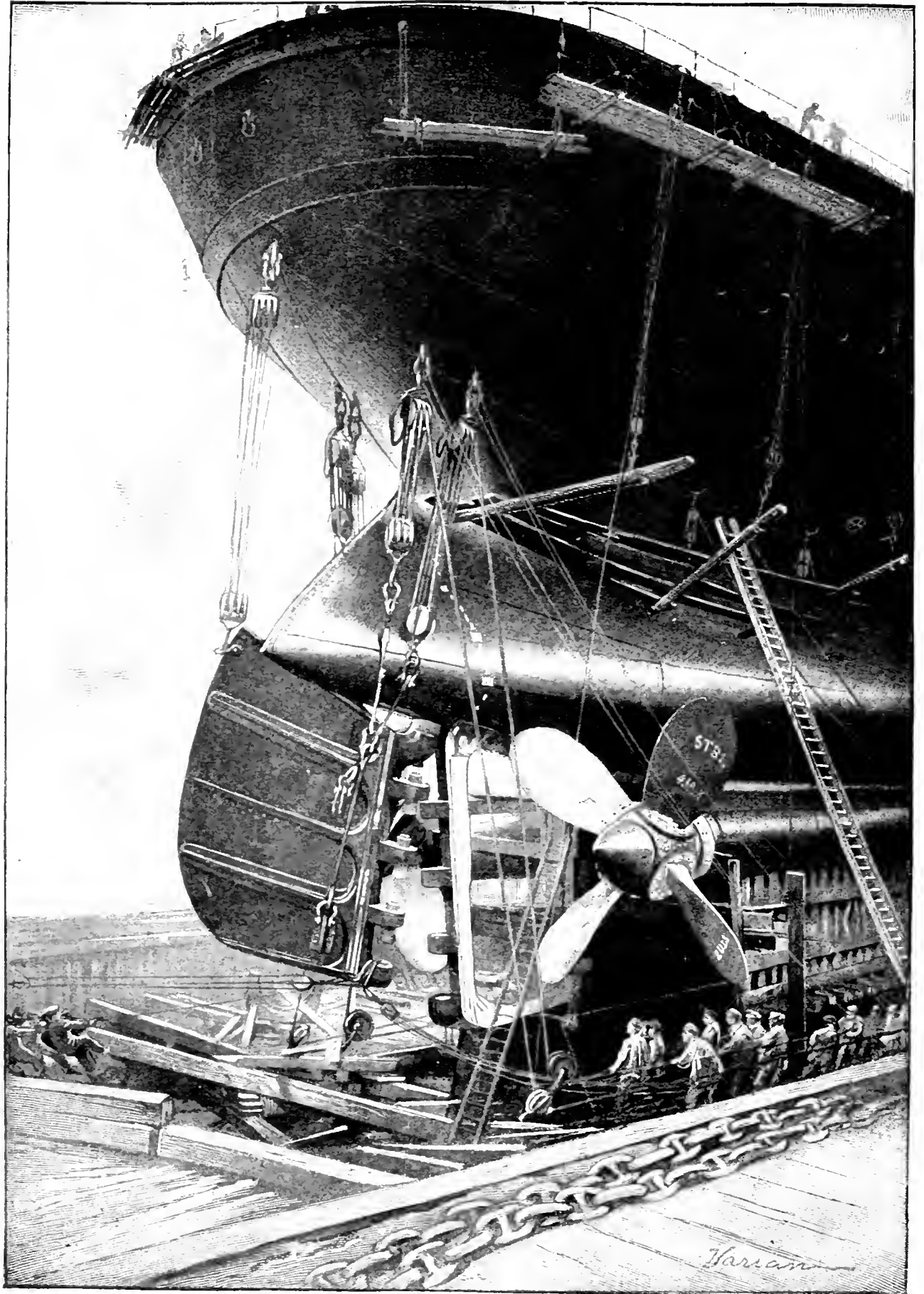
HOW THE GERMANS BUILD SHIPS

IX

HOW THE GERMANS BUILD SHIPS

The Vulcan Shipyard of Stettin

THE Vulcan shipyard at Stettin is significant of the New Germany, — the navy-building, ship-loving, world-trading Germany which had its birth almost within the reign of the present Kaiser. The Vulcan's first vessel slipped from its cradle into the Oder as long ago as 1852, at a time when the ships of the Clyde and the Severn and of our own Bath and Gloucester controlled the seas. Germany was not then a sea power, nor indeed a united nation. She possessed few ambitions beyond the land limits of Prussia, and Bismarck and von Moltke had only dreamed of the empire that was to be. For more than thirty years the ships from the Vulcan yards were few and small,—sometimes one or two a year, sometimes none at all, and once, during our Civil War, there were ten, although the tonnage of this entire number was less by far than that of many a single modern ship.



Shipping the Rudder

All this has now been changed. No longer must Germany go to England for liners and warships. She has produced her own cunning ship-builders, men trained in her own yards, and yet conversant with every improvement known to the shipyards of America or England. Not only does she build her own vessels, but so eager is she for that self-sufficiency which marks every great and warlike nation that she insists that German workmen shall also make the steel for the plates of her ships, and build the engines and boilers, forge the great shafts, design the electrical devices, and decorate the interior with German paint and tapestries.

“If we have war,” says the Kaiser, “and have need of ships, we must depend on ourselves, not on England.”

And so it has come about that Germany has built some of the greatest shipyards in the world: the “Vulcan” at Stettin, the “Schichau” near Dantzig, the “Germania” at Kiel, and the “Blohm und Voss” at Hamburg. In the 13 years from 1882 to 1895 statistics show that the number of workmen in Prussian shipyards alone nearly doubled, rising from 13,161 in the former year, to 25,343 in the latter, and the increase from 1895 to 1901 has been even larger. Germany has now the two greatest steamship lines in the world,—the Hamburg-American and the North German Lloyd,—and in the tonnage

of its merchant steamships it stands second only to England. The marvelous growth of the German navy is a matter of such common report that it need hardly be mentioned here. All this growth in shipping has served to stimulate German ship-building and to crystallize the German ambition to control the seas.

The German may be said to have developed a ship-building art of his own. This has been the result of the thoroughness which is a characteristic of his race, the minute and scientific study of details, which has enabled him to bring to final perfection the best-known processes, so that his vessels possess a distinctive character and completeness. This development and progress has been fostered by the parental solicitude of the German empire, which coddles its favored industries in ways absolutely unknown to such a government as that of the United States. For instance, the imperial government pays large postal subsidies to German steamship companies upon condition that new ships shall be built in German shipyards, in so far as possible; special rates are made on the railroads (which are owned by the government) on materials to be used in ship-building, and the duties on certain materials from foreign countries to be used in ship-building are entirely remitted. These are only a few of the many ways in which the government encourages its ship-builders.

The Kaiser himself, who is as much a sailor as he is a soldier, knows to the last detail every capability, and one might almost say, every piece of machinery, in such works as those of the Vulcan. And so it has come about that the Germans are great ship-builders, — a fact but just dawning on the world.

I visited the Vulcan works in April, 1900, and I hope by giving an account of what I saw there to convey some idea of the character and importance of the German ship-building industry. The Vulcan works are located within the ancient town of Bredow on the banks of the river Oder, where the Norse vikings once beached and caulked their ships. They are about twenty minutes by electric car from the heart of Stettin, constituting in themselves a veritable city of grim brick shops flashing with the light of forges and resounding with the din of hammers. At noon the wooden soles of seven thousand workmen clack on the cobble pavements that lead from the works, now the greatest on the continent of Europe.

At the time of my visit there were no fewer than nine huge vessels in course of construction, seven yet on the ways, and two in the water. And all about new shops were building and new machinery was being set up to accommodate the necessities of expanding enterprise. Of the nine ships seven were

for German steamship companies and one a ship of the line for the German navy, such an addition of high-class vessels as few of the great nations of the world can boast. The other two were war vessels, — one a cruiser for Russia and the other, the “Yakuma,” then just completed, for Japan. Of the German liners two were the greatest ships in the world with a single exception, and both were designed to have a speed greater than that of any existing merchant ship. And it is significant as showing how closely the government works hand in hand with the great captains of German industry, that these splendid vessels, although intended for the Atlantic passenger service and to be fitted with a degree of luxuriousness hitherto unapproached, were all being constructed under the requirements of the German navy. On the deck there were beds for the mounting of great guns, the rudder and screws were especially protected from the possible harm of shots, and apparatus was provided for steering below decks in case the upper works were carried away. Guns are always ready at Hamburg or at Kiel, the crews are organized, and in a fortnight, should the empire need them, these peaceful passenger ships could be made terrible engines of war. It may be said that Germany learned this lesson from her English cousins; now she might give instruction to her instructors. Where Germany

thinks once of her industries and commerce, she thinks twice of possible war.

In 1898 there came from the Vulcan works what was then the largest and swiftest of all ocean steamships, the "Kaiser Wilhelm der Grosse" constructed for the North German Lloyd Steamship Company. While she was building, there were those who prophesied disaster, — first because of her size and her required speed, and second because she was coming from German works. Could these Germans thus take the lead of England? These prophets had seen in the "Campania" and "Lucania," built in English yards during 1892 and 1893, the last degree of perfection in ship-building. The great success of the "Kaiser Wilhelm der Grosse" did more than any other one thing, perhaps, to establish the world fame of the German ship-builder. Hardly had she been well tested when a still greater and still swifter ship was planned, — the "Deutschland," for the Hamburg-American line, just being completed at the time of my visit. The "Deutschland" is not as long, nor quite as broad as the "Oceanic," then recently from the yards of the Irish builders at Belfast; but she is next to her in size and much swifter, — indeed, she is the fastest merchant vessel that ever sailed the seas, as she was the most costly in her machinery and equipment. But the supremacy of the "Deutschland" was even then chal-

lenged by the Germans themselves. On the ways of the Vulcan works there was a long brown spine of steel, knobbed with rivets and almost ready for the ribs. It was the keel of an unnamed ship which was to be as large as the "Deutschland"; and another was then being planned to surpass even the "Oceanic." A few years ago builders said confidently that the limit of size of vessels had been reached; now, there is none who would venture to name a limit. The time may come when an ocean steamship will have so many decks that passenger elevators like those in a modern "skyscraper" will become a necessity. Nor is this improbable when one realizes that the "Deutschland" is in reality a six-story building, to say nothing of its deep basement and its roof garden.

The time has come in ship-building when the addition of half a knot of speed is an epoch, and the Germans seem determined to keep in the lead. The builder is so hemmed in and set about with problems that the half-knots beyond 22 — and there are only a few 22-knot merchant ships — mean a vast outlay of money, time, and skill. And yet these fractional knots are paying investments. A shrewd old captain of one of the German ships said to me:

"The American likes to feel that he is making a fast passage. He likes to reckon on the day's run, and loves nothing better than to boast of a record

trip. Yet he does n't seem to mind an extra day out any more than a German."

In this catering to the demand of the foreigner whose business he seeks, lies one of the great secrets of German business success. Whether he is supplanting the American lamp-trade in China by supplying a lamp bearing Chinese characters, whether he is studying just the needs of the Brazilian native, or serving the American with a gorgeously decorated ocean greyhound, he is the same accommodating, gentlemanly shop-keeper who wins trade because he can satisfy his customer's demands better than his rival. He goes to a country, learns its language, and studies the characteristics of its inhabitants with singular patience, then he calmly acquires its trade. The English trader has never bent to this method; he has been content for the most part to talk to his foreign customer through an interpreter, and he usually takes the attitude that goods which satisfied the British market are quite good enough for any foreigner. So Germany has been going up and England down.

It is probable that if a great steamship company should order a 750-foot ship to make 30 knots an hour, the builders would take the contract, — eagerly, too, such daring has success engendered. But it would be in a spirit of solemnity. The steamship companies are not ready, however, to go forward so rapidly as that, — the money involved is too great.

Yet in the "Deutschland" they have built a vessel 686½ feet long, 67½ feet broad, 44 feet deep with a record speed of over 23 knots (about 26½ miles) an hour.

In order to force such an enormous mass of steel, machinery, and coal through the water, the builders must of a necessity construct engines such as no other ship ever had, — indeed, the greatest engines in the world, either on land or on sea. Few people will realize what that means. It requires 33,000 horse-power to drive the "Deutschland" so that she will make a fraction of a knot more of speed than the "Kaiser Wilhelm der Grosse" or the "Campania."

The greatest German warship, the "Kaiser Friedrich III.," has only 18,000 horse-power; the "Oceanic," the greatest of ships in size, has only 27,000 horse-power; the "Campania" has 30,000 horse-power. It was therefore unknown ground that the Vulcan builders covered when they undertook to build the world's greatest engines. But there was no uncertainty about it. Indeed, in ship-building almost everything depends on experience. The builders knew to almost the last detail just what was necessary to the construction and operation of such enormous machinery, the strength of every bit of metal, the sizes of the parts that would give the greatest efficiency, and yet occupy the smallest space, the proper location in the ship of the vast weights of the boilers,

the coal bunkers, and so on, — all of these facts had been established by years of experience with smaller craft. And yet it seems a marvel that such a ship with its hundreds of engines and pumps, its electrical system, its air-power system, its cunning devices for preventing accidents, and its thousand and one other important details could be planned complete in six months' time. It required the continuous work of over a score of draughtsmen to do it, to say nothing of the greater work of the men in whose brains the beautiful lines of the ship were first traced, and who planned the engines and solved to a nicety those wonderful problems of strains, and of vibration and balance, a single mistake in which might have ruined the entire creation. When one realizes how completely a great ship must be built in a man's brain before it rises in steel within its wooden scaffolding, one feels like calling this monster the mightiest work of human conception, — a work involving in its lines the highest type of beauty and symmetry and in its construction the deepest scientific and mechanical knowledge. A ship — man's greatest mechanical accomplishment! Nothing could better gauge the height of a nation's industrial accomplishment than the state of her ship-craft. I have felt, therefore, that in giving a clear idea of what was required in brain, brawn, and material resource in constructing the world's fastest and costliest merchant ship, I

should go far toward interpreting the genius of German builders.

As in other branches of art, the ship-builder must work within certain circumscribed limits. He is walled in by the practical and the expedient. If he might suit his own fancy, what a wonder of a ship might he build ! But there are certain inexorable laws of nature as well as laws of man which he must observe. They are like the rules of a race which every ship-builder, be he German or English, must observe, and if he makes his extra half-knot in spite of the rules, he is the greater genius.

For instance, if the ship-builder could make his vessel of any depth he might build much larger and there would be practically no limit to his speed ; 40 knots would be almost as easy as 23. But he must construct his ship so that it will float into the harbor at New York and Liverpool and Hamburg, where the channels are hardly beyond 30 feet in depth. At the same time, if he would have her make a high speed he must fit her with enormous engines, and yet if his engines are too large his vessel will not carry enough coal to get her across the Atlantic and leave any room for passengers. If he increases breadth to make her carry a larger load, — in other words, if he makes her “tubby,” — he cannot drive her through the water at the required speed. On the other hand, if he makes her too long in propor-

tion to her breadth and depth, she will break her back with the enormous weights which she carries and the thrust of her machinery. And yet one is astonished at the immense length of the great liners in proportion to their width. Builders have been increasing length year after year with practically no increase in width. One standing on the bridge of nearly any of the greater ships, if he have a keen eye, may see her body bending with every wave like a huge bow, — only a little, but bending. This is not a sign of weakness, but a tribute to the skill of the builder, for a ship built so as to be absolutely rigid, if that were possible, might soon be racked apart.

These are only a few of the difficulties with which the builder must wrestle, but they will serve to indicate faintly the delicacy and intricacy of the art — the necessity of striking just the proper proportions of depth, length, breadth, weight, so that the vessel will derive the greatest possible speed from the work of her engines.

After these problems of size and proportion are settled there is the further difficulty of the balancing of the great ship. The layman, seeing some such vessel as the “Deutschland” afloat with the line of her red bottom just level with the green line of the sea, little appreciates what problems have been surmounted in producing such splendid steadiness.

Here are engines and boilers weighing thousands of tons; here are bunkers which must be loaded with other thousands of tons of coal; here are hundreds of tons of other machinery, water tanks, cargo, and so on. They must all be so arranged in the long narrow shell of the ship that she lists neither to right nor to left, and so that throughout her whole 700 feet of length, more or less, she never sinks more than a few feet deeper at one end than at the other. Then there is the problem of preventing the vibration of the propellers as nearly as may be from shaking the ship, of ventilation, and of providing a strong draught of air to the furnaces forty or fifty feet below the upper deck,—all these, and many other problems quite as difficult, must be solved before the first plate of steel for the ship is ordered.

Then there are other handicaps. The marine insurance companies — the Lloyds — must be placated to the last degree, for their men are on hand to watch every step in the building of the ship. She must conform, for instance, to the hundred and one rules of safety; her forward ribs must be especially strong to resist ice or collision, she must have so many pumps, so much fire-fighting apparatus, so many water-tight compartments, and so on, else insurance cannot be obtained for her. Next there are two governments to step in and make further regulations which must be obeyed. Few people realize with

what jealousy a government watches its ship-builders to see that proper accommodations are made for passengers and crews and that the vessel is provided with safety appliances. The laws of Germany on this subject fill a small book, and the regulations are iron-clad, even to minute details. For instance, the law specifies the size of berths ; they must be at least so long and so broad, so high from the floor, and so far from the ceiling. There must be 2.8 square feet of room for each passenger on the promenade deck and so many cubic yards of space in each state-room. There must be a boat of a certain specified size for every 100 passengers, and a life-belt of a certain buoyancy for every person. The law specifies the minimum limit of medicines, provisions, and water that must be carried, and sufficient room must be made for all of these things. The window ports must be a certain distance above the water line, so that they may be opened in good weather ; the stairways must be at least so broad ; there must be hospitals for each class of passengers with four beds for every 100 persons, and so many ventilators for providing fresh air for the cabins and steerage. And when all the German regulations are complied with, the American laws go still further and demand hand-fire-pumps and a drifting anchor, so that the ship may be steered in the remote possibility of a loss of both her propellers and her rudder.

In addition to all this handicapping in the race for speed, the imperial government of Germany steps in and demands the military accessories and equipment to which I have already alluded.

With such formidable limitations before him the ship-builder must plan his vessel, and if he succeeds at the last in making a beautiful ship and a record speed, great must be his honor, and great the honor of the nation to which he belongs.

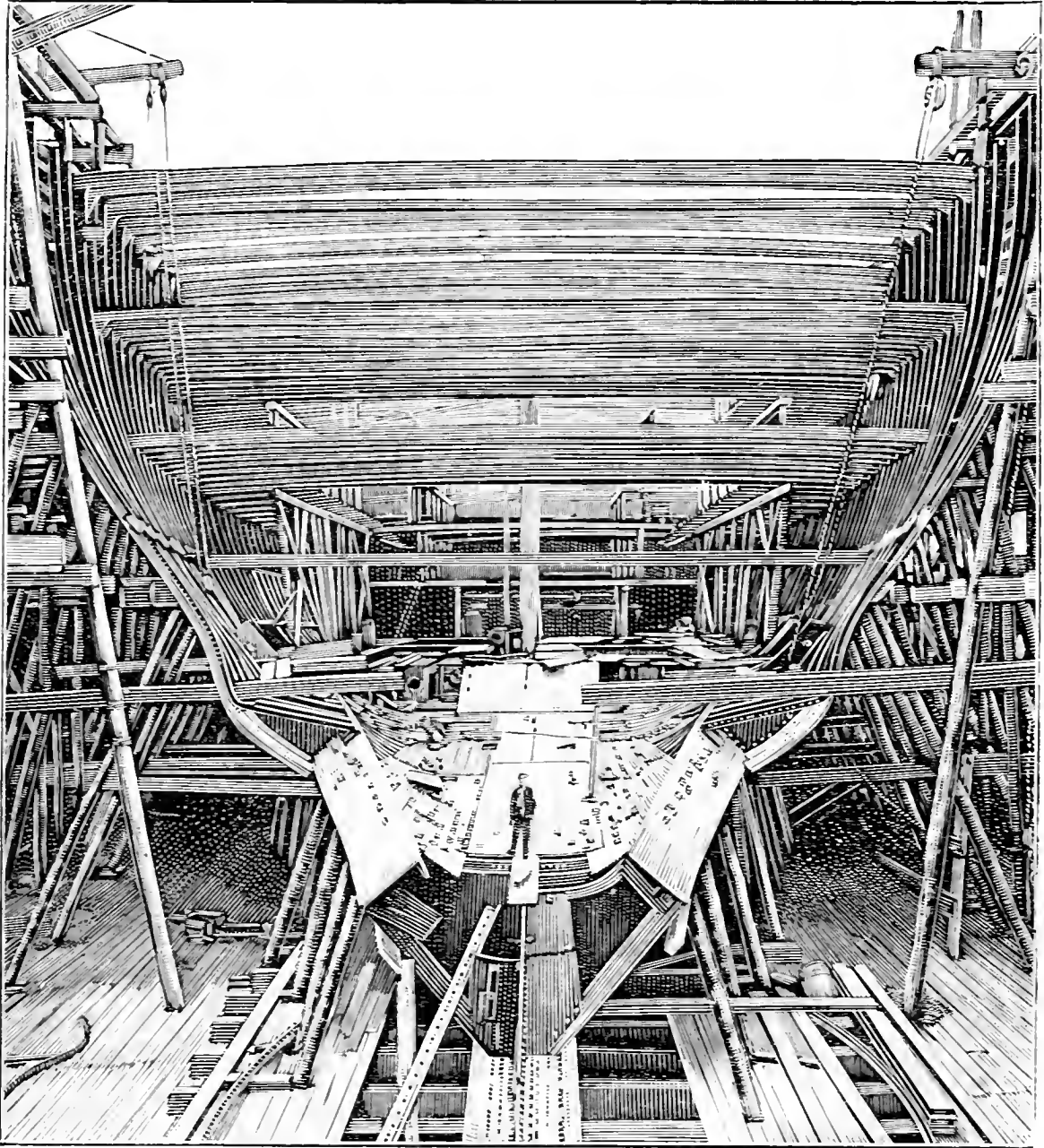
The casual visitor at a great ship-building establishment is rarely aware of the importance of this preliminary work in which the genius of the supreme craftsman has its keenest expression. He sees a few absorbed men in a loft bending over desks and drawing tables or making computations. They are not particularly impressive, especially when his eyes still see green from the light of great forges, and his ears still ring with the thunder of sledges. And yet it is here that the ship is first built — finished to the last rivet in plan and blue-print before the first block of the keel is laid in place. A score of men directed by the brains of the master engineers and designers have created a ship in six months which will require the labor of 1,500 men for nearly two years to body forth in steel.

And yet the brawn of the ship-builder is not less important than the brain — and its manifestations are much more fascinating to the visitor. For here

are the realities which the senses may grasp, — hugeness, power, toil, noise, heat, dust. These are the impressions that lay deep hold upon a man, and fix in his mind forever afterward the meaning of a great ship. Here are red plates of steel and angle irons, huge raw castings of bronze, brass, copper, steel; here is lumber, tow, hawsers, paints. They lie in shapeless piles just as they came from the mills and factories. They are without meaning — a chaotic aggregation of material. Seven thousand men in blue blouses and wooden-soled shoes, each working at his own minute task, — the beveling of the raw edge of a plate, the driving of rivet holes one by one, the stirring of white-hot forges, the endless striking on red metal with sledges, lifting, fitting, fastening, and in twenty months' time there stands forth a great ship, — a thing of matchless beauty, symmetry, power, speed, so coherent and perfect that one man by a turn of the wrist can control the movements of all her vast mass.

The River Oder at Bredow is only a narrow stream without tides or perceptible current. When I saw it first the water was a murky brown blotched with bits of rotten ice. Where the Vulcan works spread along its shore, the bank rises at a gentle slope, and here stands the scaffolding for seven ships. So narrow is the river that three of these cradles have been placed at a sharp angle to the water in order that when the

greatest ships are launched they may not crush into the opposite bank. A ship's scaffolding at a distance

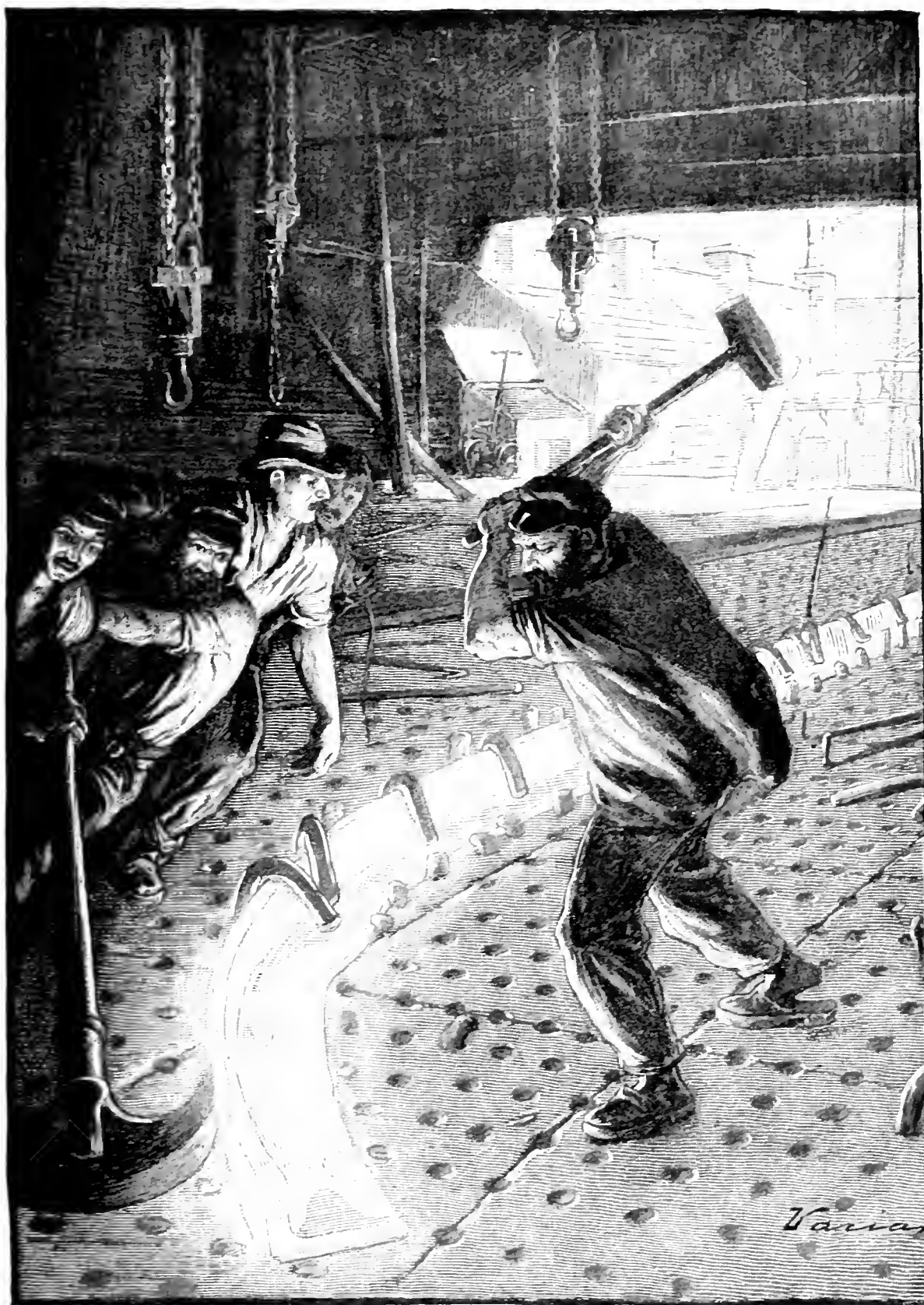


The "Deutschland" six months after her keel was laid. Showing the keel, ribs, the second, or "false" bottom, and the girders which are to support the decks

resembles a gigantic basket, one end of which rests in the edge of the water, while the other reaches

high up on the bank. On nearer approach, the sides of this basket resolve themselves into an intricate maze of timbers of enormous proportions. Here the ship is born. The interior of the basket has been cunningly fashioned by the artificer until it follows the lines of the future vessel,—a sort of huge wooden mould. At the bottom runs a long low ridge of stout timbers, called the bed, sloping down to the water's edge. This is to support the backbone or keel of the ship. In one of the cradles the keel-pieces of a new warship had just been laid. A crew of riveters were at work fastening the vertical keel-piece to the horizontal keel. Imagine a machine as tall as a man, and having the shape of your thumb and finger when fashioned in the form of a C. A boy at a hand forge throws a bursting red rivet. Another workman seizes it with tongs and drops it into a hole in the ship's spine. There is a shout and a quick signal; the giant thumb and finger of the machine close in and come deliberately together, one at each end of the rivet. There is no sound, but when the machine opens again and draws away, the lower end of that rod of iron, as thick as a man's two thumbs, has been crushed like so much putty into a rounded head. This rivet shrinks in cooling and draws the beams of steel together until they are like one solid piece. And that is the daily work of the pneumatic riveting machine.

The ribs of the ship come from the mills in long, straight L-shaped beams which must be bent to the delicate curves of the ship's body. A wide iron floor full of equidistant holes, a furnace 65 feet long,—of a length great enough to hold and heat the ship's longest rib,—a force of workmen waiting for the furnace door to open,—that is where the ribs are shaped. The master workman has pegged out the curve of a rib by fitting iron pins in the holes of the floor. When the signal is given, the furnace door bursts open, emitting a blinding glare of light and fervid heat. A single dark figure, black against the glow, grapples with huge pincers in the furnace mouth; the workmen, but a moment before standing inert and lax of muscle, now bend their shoulders to a hawser, and the bar of metal, so hot that its edges bear no definite outline, is dragged forth. With infinite deftness and fearlessness, with swiftness and yet without hurry, this flaming bar is crowded against the pegs of the curve, the workmen smiting it with hammers, driving other pegs, straining at levers, and smiting again. Once the steel wrinkled, in bending, like a blotting-pad, as if reluctant to submit. A brawny giant, his face glowing from the upward glare of the metal and dripping with perspiration, drove down upon it with a great sledge until it was flattened again into submission. In two minutes' time a simple L of iron had become a ship's rib, curving in the



Bending a Ship's Rib

shape of the hull and ready for service except for rivet-holes.

In ways just as fascinating the steel plates which are to form the outer skin of the ship are fashioned. They come from the rolling mills of Westphalia or from England in the form of square or rectangular plates of varying thickness; and they must be bent and trimmed to the necessary shapes to fit the ship. Here is a pair of enormous rollers of steel like the rollers of a laundress's wringer. Between them a plate of steel as large as two dining-tables is fed, leaving part of it sticking straight out. At just the proper moment, a third roller rises from below, pushed upward by the resistless force of hydraulic pressure. When it reaches the plate, we start back, expecting to see the cold steel snap like glass; but instead it bends upward as easily as though it were pasteboard, until it is almost L-shaped. Then the noiseless but mighty roller that has done the work slips back again. Such is the quality of the steel that goes into a modern ship,—it must stand the strain while cold of being bent almost double without breaking.

Around the head of each cradle at the Vulcan yards there is a cluster of machines covered with umbrella-like canopies of corrugated iron. There are thick, saw-like shears that trim the steel plates three-quarters of an inch thick, as a little girl would

snip the corners of a bit of calico cloth. Other machines there are that bore endless numbers of rivet-holes in beams, girders, and plates, others countersink these holes; still others level off the edges of the plates, and then a huge crane lifts them over into the scaffolding, dangles them, though they weigh ten tons each, just where they are to be placed, and the workmen fit and fasten them in.

One year from the time that the keel of the "Deutschland" was laid, her hull was finished. It loomed huge and brown through the scaffolding which still protected and supported it, and it was ready to take the sea. In January, 1900, the Emperor came up from Berlin with a brilliant guard of officers. Count von Bülow pulled the silken cord, champagne was spattered on the great ship's stern, and she shot forward into the water, almost filling the little river. There she stood exposed for the first time, unfinished indeed, but bearing the promise of her future beauty. This shell of steel weighed upward of 9,200 tons, and had cost all of a million and a quarter of dollars. There was yet to be added the engines and the fittings which would bring her total weight to over 16,500 tons, and her total cost to over \$3,000,000.

In the Vulcan shipyards one tool stands supreme in importance over all others. It goes by the highly expressive title of "shear-legs," a kind of crane.

The greatest pair of shear-legs at the Vulcan works is mounted on twin pontoons, the legs rising in the form of an enormous inverted letter V to the height of 150 feet above the water. From the top hangs heavy chain tackle which will lift a hundred tons — 200,000 pounds — as easily as a boy would pick up a penny. There is something majestic in its power, its perfect poise and sufficiency. We saw it drop its great hooks down over one of the “Deutschland’s” steel pistons which weighed something over five tons. It reminded one of the leisurely sweep of an elephant’s trunk. The hooks were made fast, a dwarf of a man blew a whistle, and the piston was heaved into the air, swung out over the water and lowered into the dark chasm of the “Deutschland’s” hold. And this is the way all of the heavy interior fittings — the engines, pumps, boilers, stacks, masts, and so on — are placed in the ship. For a clear realization of the perfect supremacy of man over matter, one has only to watch the splendid power and docility of this great crane. It might have taken fifty men a week to do what the shear-legs did easily in ten minutes — if men alone could have done it at all.

With Captain Albers, to whom fell the honor of taking the “Deutschland” on her first voyage, Mr. Varian and I went up the broad plank gangway which led from the river bank to the promenade deck of the vessel. Fifteen hundred men were there at work

on her, hammering, sawing, planing, fitting; and yet so huge was she that the force seemed small, and there were whole areas where not a man was to be seen.



Captain Albers of the "Deutschland"

These men of the Vulcan works possess their own peculiar interest to the American visitor. They are not quite so foreign as he expects: he sees the strong cousinship of sweat and grime and strength. But

for a little more, perhaps, of stoop and stolidity, a little more of patience in their faces, these might be the men of an American shop. There is work done here by strength of shoulder — heaving and hammering and lifting, that in America would be done by steam or electricity, and yet as long as man-muscle is cheaper than steam so long will it be employed. In dress, the German workmen strongly resemble the American, except in the shoes, many of which are heelless with thick wooden soles. There is also the unfamiliar German blue blouse falling from a yoke at the shoulders and hanging loose around the waist, which some of the workmen wear. The German works longer hours and earns much less money than the American ; but while food commodities are higher for the most part in Germany than in the United States, he lives much cheaper than the American, because he is willing to live on poorer fare and in homelier quarters. He does not as rule save much money, for he must have his beer and his lottery ticket ; but he pays regularly for insurance against accident, sickness, and old age, and he also contributes regularly to a burial fund so that he may be decently interred when he dies. And yet he is industrious, skilful, painstaking, and even dully ambitious. In a preceding chapter, on the German workingman, I have given other interesting facts in regard to these ship-builders of Stettin.

The space over the "Deutschland's" engines still gaped wide open at the time of our first visit, suggesting from the upper deck an enormous grimy pit. The cylinders for the main engines were still open at the top, the largest being nearly nine feet in diameter, with a weight of 45 tons, — larger than the funnels of many a large steamer. Having gone down three stories of decks, we descended a ladder fully 30 feet long, into the depths of the vessel. One may read indefinitely the cold figures relative to the size of the engines and boilers in an ocean-steamer, and still he will not realize their greatness. But let him get down, pygmy-like, among the machinery itself and look up, and he will receive an impression of size and power such as he will never forget, — and especially if he visits this greatest of all engines. When we had stooped through dark passage-ways, and climbed obscure ladders through the under parts of the enormous machinery, we came to a little door in what seemed the side of the ship. Once through it, we straightened up, and there before us another vast machine reared itself. It was the other engine, the engine that propelled the second of the twin screws, exactly like the other in every respect. It was as if one had reached the very limit of his capacity for comprehending bigness, and had then suddenly been called upon to double his impressions. After that it was interesting, but not really consequential, to know

that there were eight miles of pipes in the sixteen boilers, that there were 128 cylinders in the engines, and that the ship had nearly a third of a mile of railroad track for carrying her coal from the bunkers to the furnaces.

It was interesting to hear Captain Albers explain how the great ship was balanced, the engine just aft of amidship, boilers forward, fresh water in great tanks on each side just balancing each other, coal in the bunkers around the boilers so that in case of war the enemy's shot could not pierce to the ship's vitals, and how water could be let in from the sea to this or that compartment to balance the coal burned away. This was all interesting, but we felt more deeply impressed by the strange, cold, dark, resounding hole in the extreme stern and at the bottom of the great ship, which we reached through a door in a steel wall. Here in silence and almost without human attention, works the mighty rudder arm of the ship. It travels in a cogged quadrant, and it is so big that the engine which runs it is perched on top of it, and rides back and forth as the rudder answers the touch of the steersman's finger on the bridge a fifth of a mile away. Once every watch, a man looks in at this piece of mechanism, and once a day it is newly provided with oil ; otherwise it works alone in the dark. If you crowd to one corner of this room, and look up through a steel well of apparently incal-

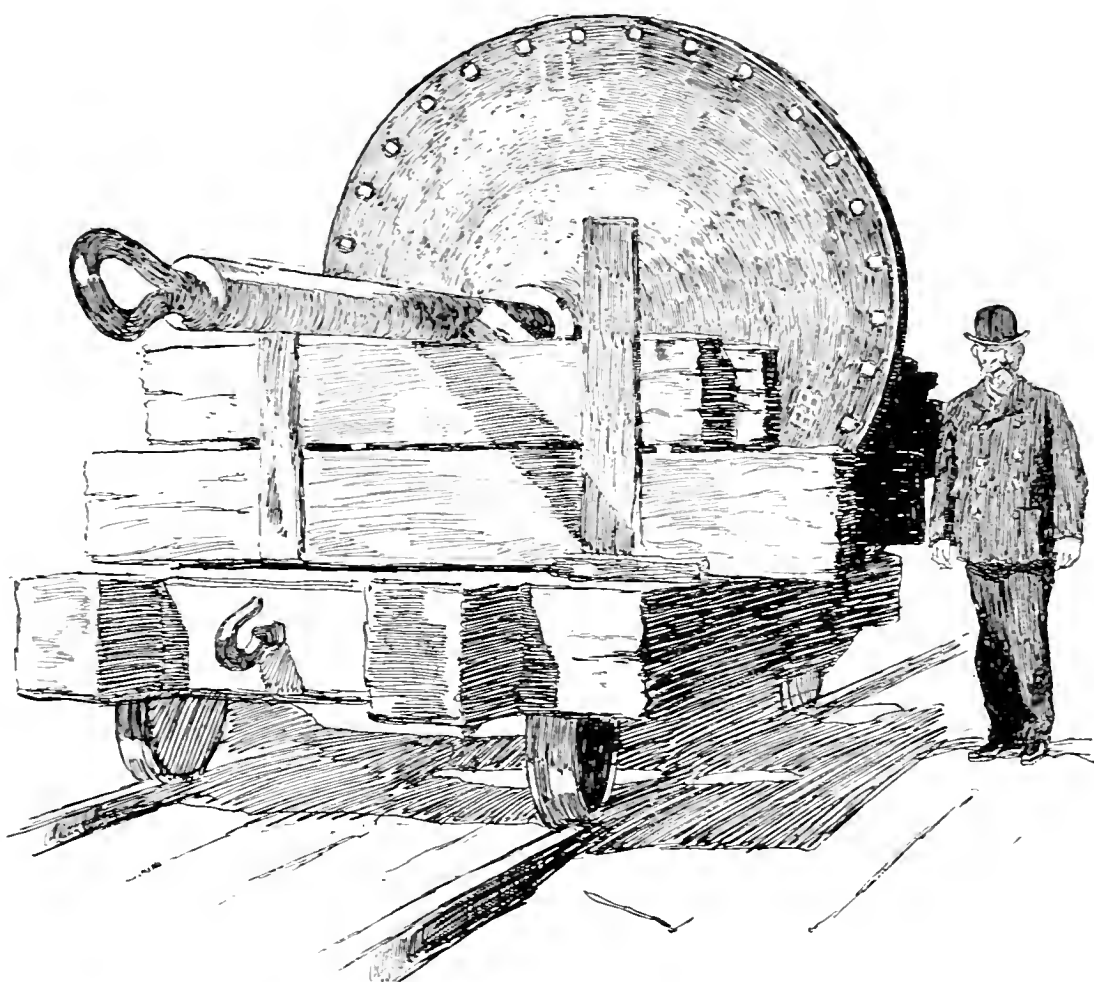
culable height, you may possibly see a bit of light. That hole may be said to have been made especially for the young Emperor of Germany. Once he said: "Suppose this ship became a cruiser, and suppose she met the enemy, and then suppose her bridge were carried away by a shot. How then could she be steered?" So that steel hole was made from the top of the ship to the bottom. A narrow ladder runs down its side, — you can see the faint daylight glint on the rounds, — and when the bridge of the "Deutschland" is shot away, the men in blue will go down the ladder and steer the ship from below, where shots cannot come.

The "Deutschland" may be said to be twenty-one ships in one. In passing up the vessel from stern to stem, we crept through numerous gangways of steel, the doors of which could be instantly closed, and so screwed down on rubber battens as to be impervious to both water and air. In case of an accident at sea, two men spring instantly to each of these doors and close them fast, and the ship, a moment before a single great apartment, becomes twenty-one separate rooms, having no connection below decks. If one or two, or even five, of these compartments fill with water, the ship will still float with the buoyancy of those remaining. And each compartment has its own pumps and its own means of escape for passengers, so that even though there is a yawning hole in

the ship's bottom, she may yet sail safely into port. No modern improvement has done more to render safe a passage of the sea than this. The "Deutschland" also has two bottoms. It is surprising enough to be walking on what seems to be the solid floor of the ship, to feel that the water is only the thickness of a steel plate from your feet, and then suddenly to come upon what seems a hole in the bottom of the ship, and to see dark, oily water a few feet below. The real bottom of the ship lies from four to eight feet beneath the false bottom; both are almost equally strong, so that if a hidden reef bursts through the outer plates, there will still remain a firm, dry inner bottom to keep out the water. This wide space — it might be called the sub-basement of the vessel — has also its own separate compartments into which water can be let at will to balance the ship, if she does not ride evenly.

After the ship's engines and boilers, perhaps the most impressive pieces of mechanism are the shafts, which reach from the engine out through the stern of the vessel, where they drive the propellers. In many respects, also, these shafts are the most difficult of any part of the ship to produce. They are made of a special, high-priced nickel steel. Each of them is 215 feet long, longer than many good-sized ships, and twice as large around as a man's body. They must needs have strength to drive such a weight of

steel through the water at such a speed. Each bears on its tip end outside the ship a screw-propeller of manganese bronze, each blade of which weighs four and one-half tons. They are the work of that great



One of the Piston Heads of the "Deutschland"

German, Herr Krupp, of Essen, and they represent the acme of the art of steel-making. Upon its arrival from the mills, each shaft is in five parts, and it looks rough and coarse. But the workmen at the Vulcan fit the pieces one by one into an enormous lathe, and plane them down as a cabinet-maker would

turn the leg of a chair. We saw such a lathe at work, and picked up fine shavings of nickel steel, curled and strong as a spring.

Such a vessel as the "Deutschland" would have been an impossibility a few years ago, not only for mechanical reasons, but because she could not have been made to pay. The "Deutschland" will carry no freight and almost no express. She is wholly a passenger and mail steamer — and she is now a possibility because people are richer and every year more of them travel back and forth between Europe and America. And to make such a speed as that of the "Deutschland" means that so much room is required by the power-producing machinery and coal that there really is n't any space for a large cargo. But for her purpose — that of carrying 1,328 passengers across the Atlantic in the least possible space of time and with the greatest luxury — the "Deutschland" is the perfection of the ship-builder's art. Never before was a ship fitted with such elegance. There will be not only single staterooms, but suites of rooms, each with its own bath, and berths that close like those in a Pullman car; there will be private dining-rooms, a special grill-room on the upper deck; there will be dumb-waiters, electric fans in many of the rooms, a special play-room and gymnasium for children, and other new conveniences.

Some few facts about the new ship may help to a

realization of what a great modern ocean-liner really is, of how absolutely complete she must be made in every particular. The "Deutschland," for instance, has a complete refrigerating plant, four hospitals, a safety deposit vault for the immense quantities of gold and silver which pass between the banks of Europe and America, eight kitchens, a complete post-office with German and American clerks, thirty electrical motors, thirty-six pumps, most of them of American and English make, no fewer than seventy-two steam-engines, a complete drug-store, a complete fire department with pumps, hose, and other fire-fighting machinery, a library, 2,600 electric lights, two barber-shops, room for an orchestra and brass band, a telegraph system, a telephone system, a complete printing establishment, a photographic dark room, a cigar-store, an electric fire-alarm system, and a special refrigerator for flowers. And she is one of the two great foreign liners having four funnels; the other is the "Kaiser Wilhelm der Grosse." That is the way that these two leviathans may be known from all other ships. She also has the usual two masts. They look stubby enough when mounted on her vast bulk, and yet they are so tall that the "Deutschland" could not get under the Brooklyn Bridge at New York, and so large around that while they are building a man lies inside of them driving rivets.

As the "Deutschland" lay completed at the Vulcan

yards, she sank so deep into the water that she could not of her own power get out to the Baltic Sea. The River Oder was too shallow to permit her passage. As a consequence, it was necessary to lift her over the bars by means of a number of great steel boxes or pontoons. An equal number of these pontoons were arranged on each side of the vessel, and as they lay there filled with water, enormous chains were passed between them and under the ship's keel. Then the water was pumped from the pontoons, and as they grew lighter they lifted the "Deutschland" with them, just as a life-preserver raises a man out of the water.

But in spite of these measures, the "Deutschland" ran aground on a bar when part way out to sea. With characteristic vigor, the Kaiser, when he heard of the accident, sent one of the vessels of the imperial navy to help drag her off, showing the keen interest which the government takes in the welfare of her merchant marine.

As we last saw the "Deutschland" at the Vulcan yards, she was within a few weeks of her first sailing. She had not been painted, but dabs of red and chalk-marks covered her steel sides from stem to stern, and down close to the water near the bow, where she would first touch salt water, some German workman, with feeling for the monster on whom he had so long been toiling, had scrawled in big letters, "Glück auf," "Good luck."

X

SOME NEW EDUCATIONAL IDEAS IN
GERMANY

X

SOME NEW EDUCATIONAL IDEAS IN GERMANY

A Commercial University — History-Teaching by Object-Lessons, School Gardens

IT is now a good many years since the world began going to Germany for educational ideas, and Germany seems to be provided always with a new supply. The Germans have apparently developed an instinct in the matter of education. Having originated a new industry, or built an especially interesting building or piece of statuary, the next step, as a matter of course, is to utilize this new material for educational purposes, either to advance the new industry, or to impart the significance of the new building. The educator is never more than a step behind the manufacturer and business man; he is nothing if not intensely practical. The manufacturing spirit of Germany gave birth to the best and greatest technical schools in the world, and they in turn have stimulated the spirit which produced them. In the same way, when Germany rose in power as a commercial nation, her educators at once began devising means for training young men in those branches of

special knowledge which would fit them for promoting in the highest possible degree this new development of German activity. The German has learned the profound lesson that a specially educated man is invariably more valuable in any given line of activity than a man who has merely a general education. Even a horseshoer is better for a thorough education in his especial art, — hence the famous horse-shoeing school at Dresden.

I visited the new Commercial High School (*Handelshochschule*) at Leipzig and had the pleasure of an interview with its director, Professor H. Raydt. It was interesting to learn how this school came into existence, for no recent educational enterprise is more significant of the alertness of the New Germany in grasping future necessities and in providing means for supplying them. In the first place, there was the great fact that Germany was building up an enormous foreign commerce, and that every year a large number of trained men was needed to carry on this business. For some years Germany had possessed commercial schools of two different ranks, namely, the “commercial continuation schools” (*Fortbildungsschulen*), intended to give elementary education to young clerks, especially those employed in the retail trade, and the so-called “commercial schools” (*Handelsschulen*), similar to the commercial colleges in this country, offering a thorough practical education in the require-

ments of a commercial career, such as knowledge of modern languages, book-keeping, banking, commercial arithmetic, geography, and so on. But these schools, good as they were, did not supply such high class men as were needed for waging the bitter struggles for commercial supremacy in foreign lands, — meeting the alert American and the experienced Englishman. This need must be supplied.

In 1896, a number of members of the Leipzig Chamber of Commerce began the movement for the establishment of a new school, which should be in effect a commercial university. They worked so vigorously that in a short time they had interested all the other Chambers in Saxony in the scheme, and a united appeal was made to the Saxon government. There was no delay ; it was a good work and the administration at once provided for the establishment of a school, to be supervised by a senate thus composed : one representative of the Saxon government, one representative of the city of Leipzig, the president and two other representatives of the Chamber of Commerce of Leipzig, three professors in Leipzig University, two teachers in the old commercial school at Leipzig, and the director of the new school.

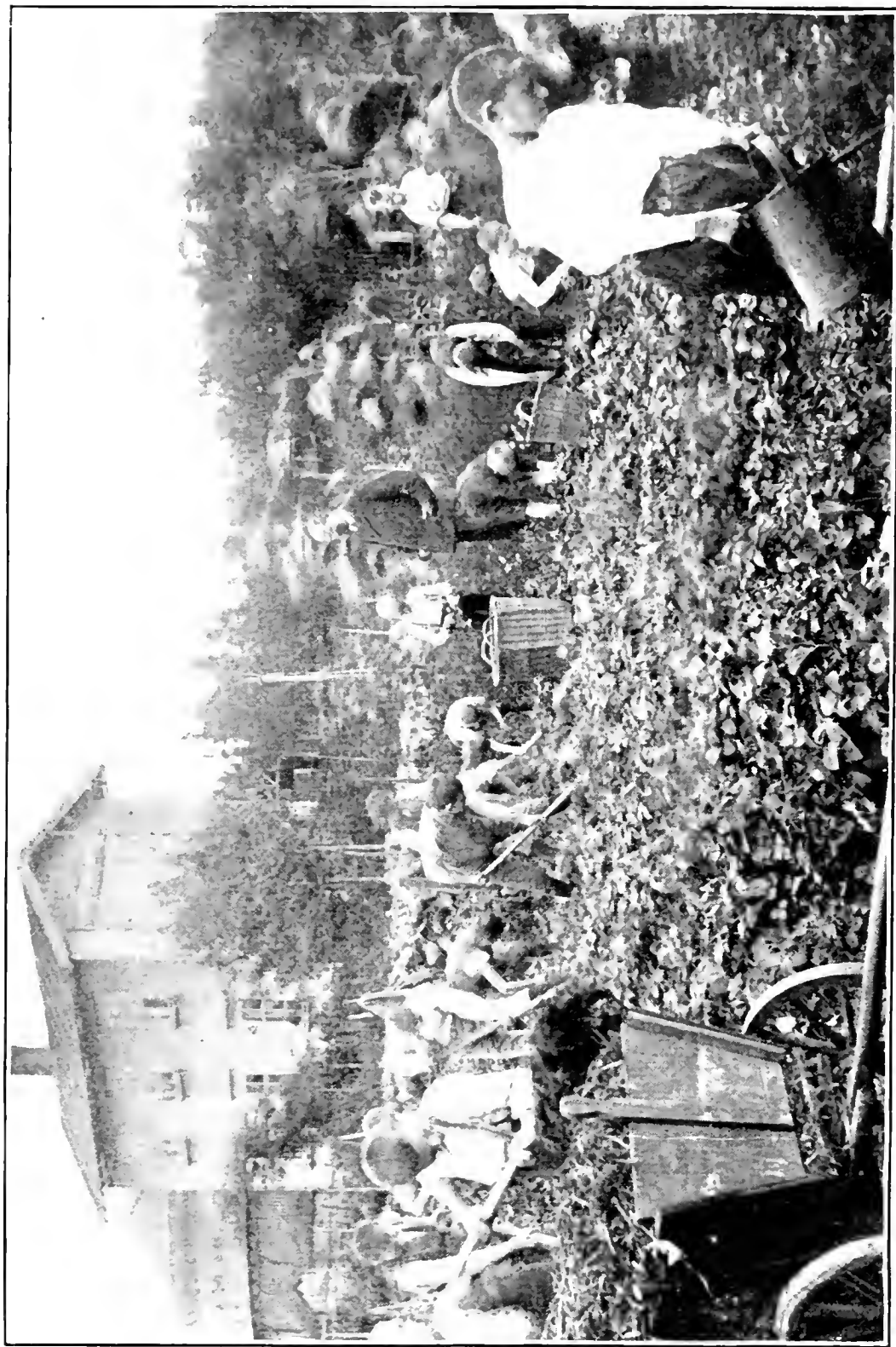
With characteristic German caution, the school was started at a minimum of cost. Teachers were mostly provided from the University of Leipzig, and the total outlay did not exceed \$2,000 a year, of which

§1,250 was guaranteed by the Leipzig Chamber of Commerce and §750 by the Saxon government.

The Handelshochschule was opened on April 25, 1898, and the first students were graduated at Easter, 1900. The course is two years in length, but students may enter at any time and remain as long as they see fit. As in the German Universities, the Handelshochschule has two classes of matriculates, first the regular students (*die Studierenden*) and the "lecture visitors" (*Hörer*). The average cost to students is about §50 a year, and board and lodging in Leipzig can be had at a low price.

It was not expected that more than fifty students would attend the school during the first year, but there were ninety-seven enrolled during the opening semester, and at the time of my visit in the spring of 1900 there were more than two hundred and fifty students in attendance, and they came not only from Germany, but from many foreign nations — especially from Austria, Belgium, and Russia. Some of them were men of maturity, over thirty years of age, who yet wished to fit themselves for a commercial life; the average age of students, however, was about twenty years.

The course of instruction is eminently practical, including such subjects as economics, public finance, commercial and maritime law, the history of trade, colonial history, theory of modern socialism, inter-



Children at work in School Garden

national law, statistics, social questions, commercial geography, modern political history, economic and constitutional history, chemical technology, correspondence and book-keeping, stenography, typewriting, and practical training in the Chinese, French, Italian, English, Spanish, and Russian languages.

Especial attention is given to the languages, with the intention of making every student proficient in ordinary correspondence and letter-writing, — such knowledge as will be of practical value to the man of affairs. The students are also allowed to select courses in the University of Leipzig, and they have all the other opportunities which that famous old institution can provide. Every student is allowed to choose his own course.

It is expected that the school will fit a man to engage in any of the growing German export and import industries, giving him such a knowledge of foreign language and law that he can fight a thorough-going business battle anywhere in the world. Certainly, such an addition yearly of trained men to the ranks of business cannot fail to have a profound effect in winning commerce for Germany, especially in view of the fact that most Americans and Englishmen embark in business without any special training. The struggle among the nations of the future is to be commercial rather than military, and Germany has gone into the work of thorough preparation, in a way

to make her rivals pause and take thought. It is by no means wise for Americans to count too much on their splendid natural resources and the energy of their workingman; science and thorough education, such as Germany is bringing to the struggle, must not be neglected.

Another new idea in education, which, while of less importance than the commercial high school, is yet significant of the trend of educational development. It was in Germany that the system of teaching from object-lessons, of which the laboratory method is an outgrowth, had its beginnings. Every year sees the value of this system more clearly proved, every year shows striking new developments. One bright afternoon in the Thiergarten in Berlin I saw a large class of girls marching up one of the walks with the master at the head. Out of curiosity I followed slowly. They stopped finally before one of the splendid new groups of statuary which the Kaiser is building to commemorate the deeds of his forefathers — the Hohenzollern family. Each group represents a king and his two chief councillors, graven in marble and of life size. The master gathered his class around him and began telling the story of the king and of the characters of his two advisers, and of the great deeds they did. It was a good story, and with the marble faces there before them this bit of German history must have remained fixed in each pupil's

mind, besides giving her a new idea of the glory of the German nation. I learned that visits to the various statues and new buildings were a regular feature of school life in Berlin and other German cities; one cannot help comparing it with the old method of history-teaching.

A similar development is the school-garden system that has grown up in a number of German cities, notably Plauen in Saxony and Leipzig, where I visited the gardens. The plan is exceedingly simple. A plot of ground within easy reach of the schools has been set aside for the growing of all sorts of vegetables, fruit, flowers, and weeds. It is under the direction of an expert gardener who is also more or less of a botanist. On Wednesdays and Fridays large classes of boys and girls may be seen marching through the streets to visit the gardens,—a kind of outing that is both vacation and schooling. The master accompanies his class and directs a lesson in transplanting trees, sowing all the various kinds of vegetable seeds, trimming the fruit vines, cultivating the ground, gathering the crop, and lastly, preparing and fertilizing the soil for the crop of another year. The advancing season brings a new lesson each week, from the methods of killing cabbage butterflies in spring, to the testing of a melon to see if it is ripe in the fall. Here, also, in certain places weeds are allowed to grow, that each boy and girl may learn to

know his garden enemies and how to exterminate them. Poison ivy and other poisonous plants are grown in a plot by themselves, and they, too, are



A Lesson in Tree Planting

studied, so that they may be instantly recognized and avoided in the woods. Nor is the information all practical; while the pupil is learning gardening, the teacher also instructs him in botany, zoölogy, and entomology. It is wonderfully interesting on a bright

afternoon to see this Leipzig garden with its swarm of children, — some chasing cabbage butterflies and learning why they are butterflies and not moths, where they lay their eggs, and how they pass through their various stages ; others picking strawberries, while the teacher explains what strawberries are botanically, how they put out runners, and how they may be transplanted. Others are hoeing and raking and learning how the pulverization of the soil admits air to the roots of the plants, and so on, combining science and practice in a way that not only fixes the facts in the pupil's mind, but gives them significance and importance. The school garden at Leipzig is beautiful as a bit of landscape-gardening ; it has a charming pond full of water plants, with a pavilion near at hand under which the pupils may seek shelter in case of rain. To these beauties the German boy and girl bring a natural love for flowers and out-door life, and the instruction in artistic arrangement, floral effects, and so on comes easily and naturally.

All this not only brings vigor and interest to the pupils, but it inspires them to start little gardens at home, where they take the greatest interest in putting their learning into practice. German children go to school longer during the year than Americans, having only four weeks of vacation in summer, although they have two weeks at Christmas, two at Easter, and a fall vacation of two weeks in October ; so that these

school gardens help to give them more out-door life. Every two weeks the gardener has a circular printed and distributed, telling what plants are in bloom,



In the Leipzig School Garden

what fruits are ripe, and the like, so that every child may see them, in this way learning botany by actual observation on the ground. This is the more necessary because German city children have very little opportunity of seeing how the wild plants grow,

because most of the forests and fields that are uninhabited are posted with notices forbidding any one to enter. The school gardens are open all day long and every day but Sundays and holidays, and they are very carefully attended by skilled gardeners, so that they may be models of perfection for the children to follow. These gardens are found in many German, Swedish, and French towns, and there are a few elsewhere in Europe; but the Americans have not yet taken up the idea, and American boys and girls lose one of the great joys of school life.

XI

A GLIMPSE OF GERMAN STUDENT LIFE

XI

A GLIMPSE OF GERMAN STUDENT LIFE

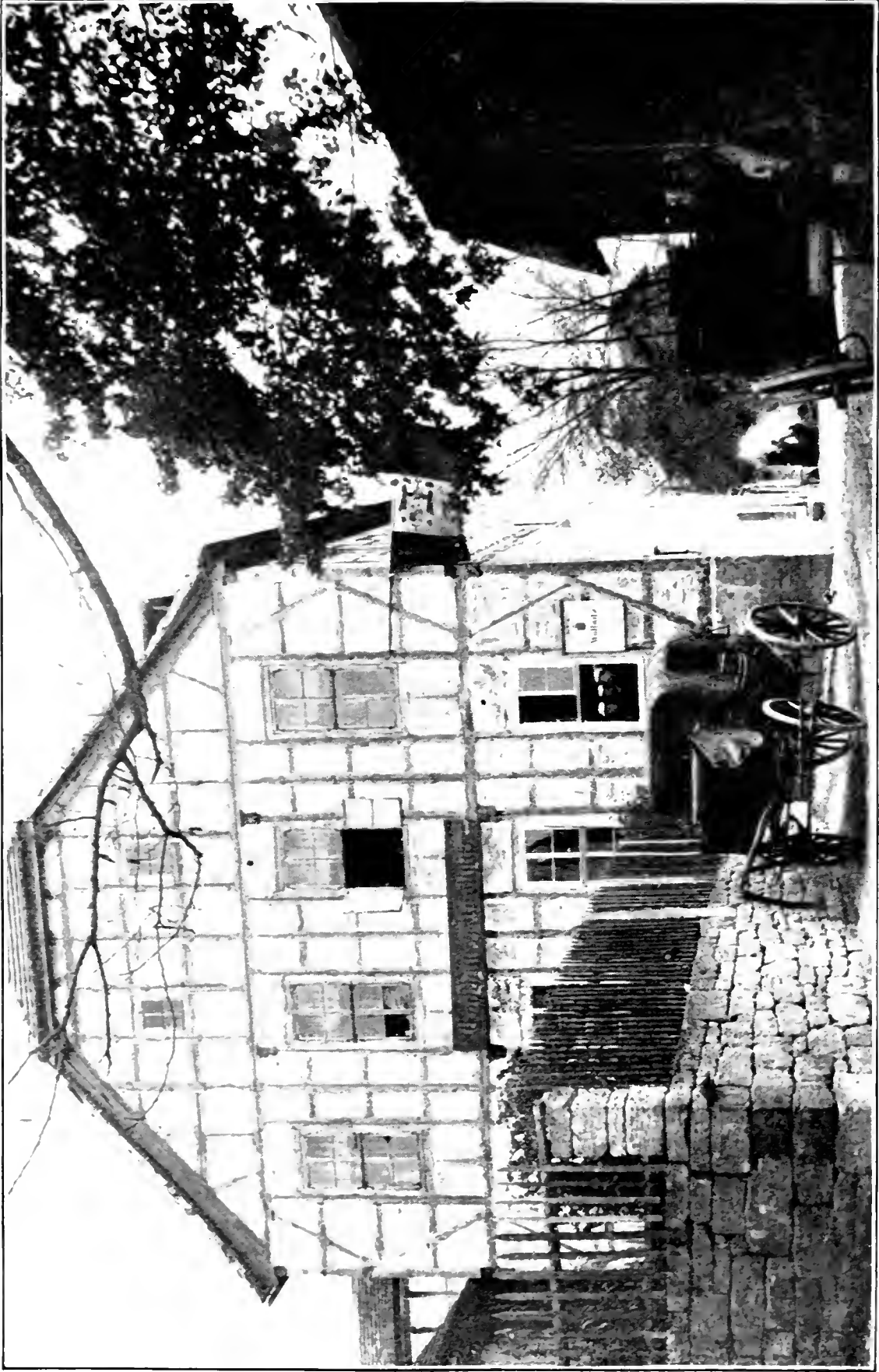
A Corps Duel at Wöllnitz

WE were informed that the duelling would begin at eight o'clock in the morning, but that if we wished to see a really good and bloody duel it would be better to come a little later. For this particular day's fighting the Hanoverian corps — Hanoverian being quite as good a name as the true one — had chosen the dorf of Wöllnitz, famous for some hundred years as the scene of student duels. Wöllnitz is a quaint bit of red-roofed village, with fat ducks rocking about the street in the sunshine. Early in the morning the inhabitants go up to the green toy farms which lie tip-tilted on the mountain side, and on Saturday the students come to fight duels.

We reached Wöllnitz at half-past nine. It had been a drive of something more than three miles from the University, — a drive of surpassing beauty, for the mountains were white with May blossoms, and in the valley we caught glimpses of a thread of water among spreading green meadows. A turn in the

steep road brought us suddenly upon the gasthof of Wöllnitz, an odd-gabled and ancient building bearing the emblazonment of the Grand Duchy. Across the street some eighty students in gay colored caps sat quietly drinking beer. The president of the Hanoverian corps met us at the steps, clicked his heels, and bowed solemnly. Then all of the other Hanoverians arose, lifted their caps, clicked their heels, and bowed, also with solemnity. We took our places on the president's right. A huge tin pot of beer stood in the middle of the table, and we were served with squat wooden mugs, having curious flapper tops ornamented with initials and the mysterious geometric symbols of the corps. The president lifted his mug and said, "Prosit." We all lifted our mugs in response, and the initial ceremony was over. The German student is a man of many formalities.

At first we had seen no evidences of the duels which we had come to see. Everything seemed perfectly amicable and tranquil. A rosy-cheeked maid was serving sausages and rye bread, and the students were joking her good-naturedly. Apparently there was not even any talk of duelling. But presently a student surgeon came in wearing a long white blouse. His blue visor cap—the cap of his corps—was cocked jauntily on the back of his head and his arms, bare to the elbows, were blotched with blood. A little later still other surgeons appeared,



The Inn at Wollnitz

all more or less bloody, and then we saw a student with sundry patches of cotton on his head and face, bound down with black bandages fastened under his chin. The portions of his face left exposed were ashy pale, but he walked steadily and wore his corps cap with spirit, if a bit comically, on top of his bandages. These students took their places at the various tables without eliciting especial interest. It so happened that the wounded duellist belonged to the Hanoverians, and when he took his place at our table his fellow-corpsmen raised their mugs ceremoniously in his honor, and he responded promptly, drinking as long as the best of them. We were informed that it had been a good duel; a Hanoverian explained with some show of pride that the other duellist was not yet able to appear. All of which was illuminating.

It seemed that we had arrived in the recess between two duels. After a hard battle it takes some time for the surgeons to do their work, and while this is going on the other duellists and their friends engage in solemn merriment with beer across the street. Everything proceeds with decency and in order. A fighting committee composed of a member from each student corps arranges the programme of duels, and there is never any hitch in the performances. On this particular Saturday extra interest had been aroused by the presence of three scarred and vet-

eran fighters from the University of Berlin, who had come down, like the knights of old, to fight any one who dared to meet them, with or without offence. They wore red caps and sat in a far corner of the pavilion. It was understood that they had all been matched—for the honor of the University. There was also a Heidelberg man, but the programme was already so well filled that he could not be accorded the honor of any more scars.

The next duel was to be fought between champions of two of the other corps,—the Hanoverians furnishing only the umpire. Of these two the Tyroleans wore green caps with green and white ribbons across their chests, and the other, the Bavarians, wore purple caps with purple, white, and black ribbons. The “foxes”—that is, the freshmen—of the green-cap corps were clad in brilliant green coats with long tails and brass buttons, and instead of the regulation visor hats, they wore milk-white fatigue caps of an old-fashioned military type. Our own Hanoverians wore still different colors, both in caps and in ribbons. These brilliant color-contrasts gave the scene its own strikingly unique interest.

At last the bloody surgeons having each eaten a sausage and consumed a mug of the pale beer, a tall student, beer-mug in hand, walked out of the pavilion, crossed the street, and entered the inn. The two corps most directly concerned in the duel soon

followed him, and we who were merely spectators came last of all. The duelling hall was a long, low, raftered room set about with tables and benches. In the centre there was a strip of black canvas, well sanded, on which the duellists were to stand. Blood was spattered everywhere, on the whitewashed ceiling above, on the walls and windows at each side, and there was fresh evidence of the last duel on the floor. The spectators formed a ring about a sword's length from the place where the contestants were to stand, those behind mounting on the benches and tables, until the whole room was walled in with human faces, and most of those faces bore the gashes and scars of just such conflicts as the one we were now to see. Two surgeons came in bringing a bowl of some antiseptic solution, a roll of absorbent cotton, and a bundle of bandages. They had added oil-cloth aprons to their white surgeon's blouses. A student in a purple cap arranged a chair at each end of the canvas strip, the backs facing.

And now came the duellists themselves with their seconds. An American university crowd would have cheered madly, each corps for its favorite fighter; but there was no sign of excitement or enthusiasm here, although every eye was fixed on the combatants. They were both powerfully built men, so tall that when they raised their swords the points barely escaped touching the ceiling. Both bore the scars

of past duels, and both had the reputation of being hard fighters.

The seconds and the other attendants looked narrowly to the adjustment of the armor. And such armor as this was! A knight of the old crusades could hardly have been more completely protected. Thick leathern stocks or collars covered each combatant's throat, holding his chin squarely in place and preventing the possible severing of the jugular vein. Thickly upholstered pads covered the shoulders. The front of the body, from just above the heart downward, was protected by a shield not unlike that worn by an American baseball catcher, only much heavier and thicker. The shields worn by both of these duellists had a peculiar bronzed appearance, which we took at first glance to be the natural shade of burnished leather. On closer examination, however, we discovered that this color was the result of the blood of many battles, — the same armor doing service in the duels of an entire corps. Heavy, out-jutting spectacles protected the eyes of the duellists. They were held in place by stout straps which, in passing around the head, bound the ears firmly back. We observed, however, that parts of the ears protruded above and below the straps, a fact accounting satisfactorily for the fashion among advanced German students of wearing their ears squared either at top or bottom or both. All the combat-

ants' heads, therefore, except the eyes and part of the ears, were entirely unprotected, although, as we afterwards learned, in some duels there is an agreement to permit the covering of the nose, some students preferring to retain their noses intact. It is the sole purpose of each duellist to cut his opponent somewhere in the face or head, else the scars will not show and much good honor will go to waste. This is the chief purpose of the thorough protection of the body and the exposure of the face.

We observed that each second gave especial attention to the covering of his chief's sword-arm, which consisted of a heavy cloth pad extending from the shoulder down to the wrist. The stress of many duels had cut the outer covering of this portion of each duellist's armor into picturesque and bloody tatters.

And now the opponents are faced, looking squarely into each other's eyes, and yet making no sign of recognition, and saying nothing, not even to their seconds. It is a point of honor that there must be no show of emotion. Each wore the gay cap of his corps, visor turned behind. As they raised their arms, each second stepped quickly forward and fitted his chief's gloved hand into the basket handle of the sword. A most disagreeable weapon is this sword ! Somewhat shorter than a fencing rapier and flatter and thinner, square at the point, and as sharp as a razor.



Interior of a Corps Room where Drinking Bouts are held

The combatants step deliberately toward each other on the black canvas, until they are exactly a sword's length apart. One might almost have touched the other with his hand; they were so near, indeed, that we who were uninitiated could hardly understand how, with such swords, they could escape cutting each other all to pieces.

With ceremony the umpire mounted a bench at one side with a school boy's slate in his hand. The two seconds, both of whom were armored almost as effectively as their chiefs, especially about the eyes and shoulders, lifted their hats and bowed. The umpire lifted his hat. The duellists said nothing at all, but looked into each other's eyes. At a word from the umpire the seconds removed the corps caps of the duellists, so that they stood bareheaded. This is the sign that there is no withdrawal.

The seconds now spring to their places with feet wide-spread, each just at the left of his chief. The spectators crowd back a pace, for sometimes the points of these swords fly far. Each duellist clenches his left hand behind him in the lacings of his armor. Up go the swords with a flash, the points nearly touching the ceiling. There is a moment's pause, distressing enough to one not inured to duels. Then one second shouts: "Bind swords."

Instantly each of the seconds rests the point of his sword behind that of his chief, so that he may not

strike until the final word is given. "Bound," comes the reply, followed immediately by the shouted word, "Los" (loose).

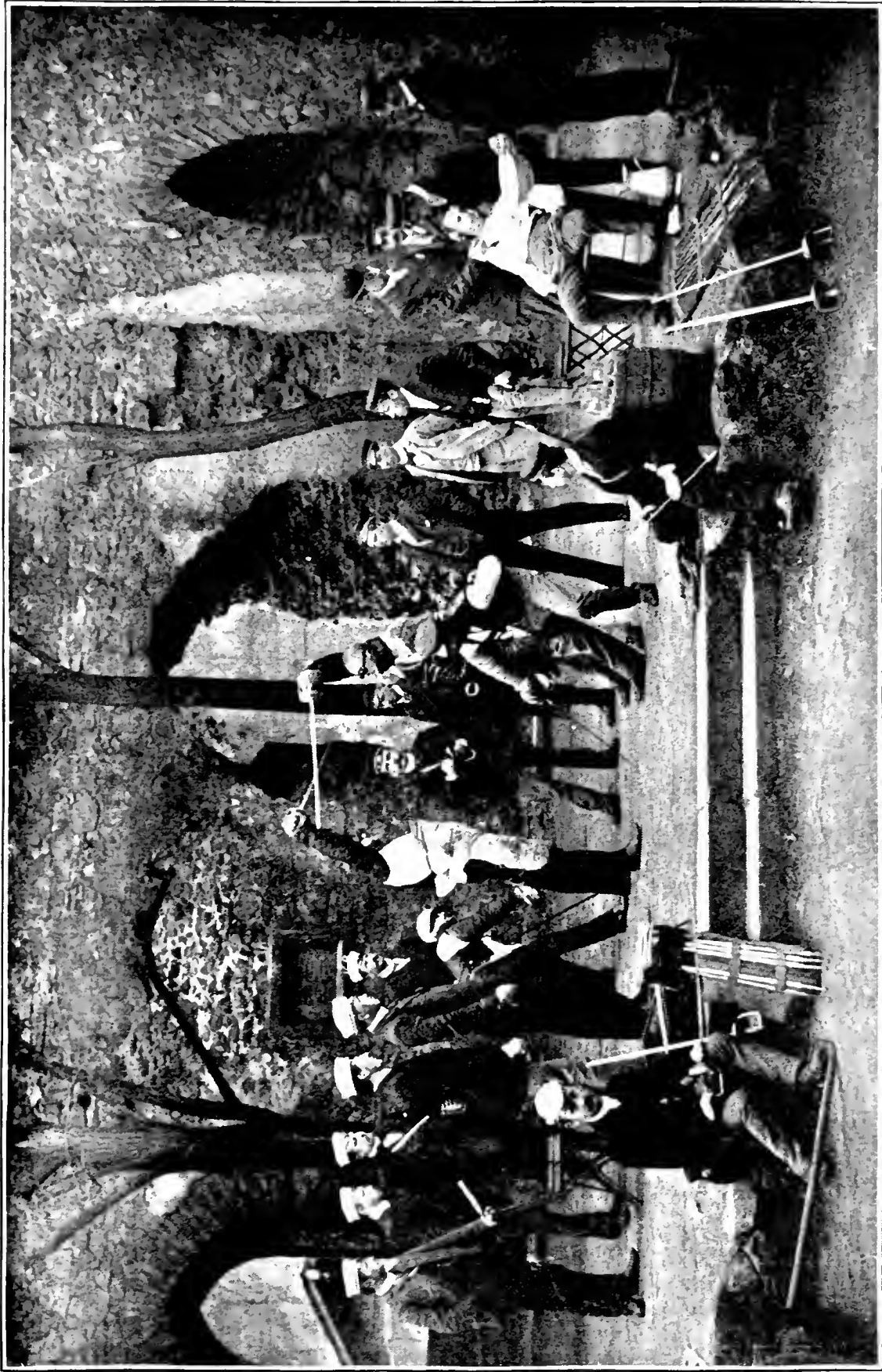
There was a downward rush of black-padded arms, a flash of swords, a din of clashing steel, and then, before the battle seemed fairly begun, there was a shouted "Halt," and the seconds rushed in with their swords and threw up the blades of the fighters. So quickly was it over with that one imagined there must have been some mistake, but this was merely the first round. It had lasted perhaps five seconds, and there had not been to exceed four swift strokes and parries of each duellist's sword. The chief surgeons came up and examined the duellists' heads in the most matter-of-fact and business-like manner. There were no wounds. A fellow-corpsman lifted the sword-arm of each fighter, holding it out horizontally, and another supported each sword. A duel imposes a hard strain on the fighter's sword-arm, heavily padded as it is, and it must be thus held up between rounds.

Everything had been done with so much seriousness and formality, especially the examination of the surgeons, and the round had been so short and so bloodless, that an outsider could not help feeling that a German student duel had its irresistibly humorous side.

A moment sufficed for the rest. Again the swords

went up, again the seconds shouted, and again at the word "Los" the clashing of swords began, this time more swiftly and fiercely. Suddenly we saw a lock of hair shoot from the head of one of the fighters, instantly followed by the shouted "Halt" of the seconds and the upward sweep of the swords. The hair had fallen from the purple — Bavarian; the umpire marked down credits for the green — Tyrolean. Again the surgeons made an examination. There were no wounds, but there needed no other evidence as to the keenness of the blades than the smoothness and closeness with which that lock of hair had been clipped. We could see the bare place above the Bavarian's ear where it had been. The Tyrolean corpsman was slightly taller than his opponent, though not so powerful of build. He wore a heavy black moustache. The Bavarian had been slightly pale from the first, but absolutely unwavering.

The third round was already beginning with that peculiarly shrill "Los." Apparently there were only two fierce flashes of the swords before the shouted "Halt" of the seconds. But this time the surgeons hurried forward more eagerly. Across the Bavarian's cheek, from the ear nearly to the corner of the mouth, there was a long, livid line, just beginning to drip. The sword had cut almost through the cheek. Both duellists stepped back, and the chairs were advanced so that they could lean against the backs: a duellist's



An Outdoor "Mensur" or Duel

armor is too stiff for him to sit down comfortably. We saw now where all the blood came from. The doctors were busy with cotton, but they did not attempt to put on bandages. We were just beginning to feel relieved that blood had at last been shed, and that the duel was well over with, when the combatants again advanced, measuring a sword's distance between them and lifting their blades. Again there were the shouted signals, and the fourth round began with the din of parried blows. We had quite mistaken the nature of a German student duel in thinking that first blood counted in any way except on the umpire's slate.

In the fifth round, the Bavarian returned the cut, slashing the Tyrolean across the scalp, so deeply that the blood instantly gushed down over his forehead and from his spectacles to the floor. Again there was a rest on the chairs. This wound was so deep that not only was cotton applied, but a narrow leather disk was passed across it and fastened down to the ear-straps on each side. This did not seem, however, to stop the flow of the blood. Indeed, the surgeons in these duels never attempt to quench the wounds, for the excellence of the performance depends on a liberal flow of blood.

After each wound, the swords were wiped with cotton dipped in the antiseptic solution, for the German duellist is nothing if he is not scientific. As the

rounds progressed, we saw more clearly how the fighting was done. There was none of the movement and activity of the ordinary swordsman's conflict, none of the splendid clash and parry, or advance and retreat. The duellists stood stock-still: it was dishonor to give way by an inch; it was dishonor to move the head in the least, or to dodge a blow, no matter how severe the wound. The entire contest consisted in holding up the sword-arm, and in so using the hand and wrist that the point of the sword would slash the opponent's head. Much depends on the strength and endurance of the right forearm, for upon it fall most of the blows, and if it gives way a wound almost certainly follows. An old fighter becomes exceedingly strong and dextrous with both wrist and forearm; and yet one cannot but reflect that all this training would go for nothing if one of these duellists were called upon to defend himself from an ordinary sword attack, such as a soldier might have to meet. The whole training is special, an outgrowth of the student duel.

It was plain that the Tyrolean was the better fighter of the two. The longer the duel progressed the fiercer became his onslaughts, and in nearly every round he struck the Bavarian somewhere on the head or face. Blood was spattered everywhere, on the floor, on the clothing of the seconds, and on the surgeons. As for the duellists themselves, they were literally bathed

in it; it even ran down their bared backs under their armor lacings. Once the Bavarian removed a bit of tooth which had been broken off as the Tyrolean's sword ripped through his cheek. These things are not pleasant to relate, nor pleasant to see, but without them one cannot arrive at an understanding of what a student duel really is.

Nor were the wounds and the blood the least distressing features of the fight. It was a warm morning. The room was packed to suffocation with students, and, astonishing as it may seem, not one of the windows was open, and the single small door was blocked with spectators. Add to the stifling atmosphere much tobacco smoke and the rank smell of beer and blood, and a faint conception of the condition of the room may be formed. The spectators suffered enough from the heat and bad air, but it must have been nothing as compared with the torture of the duellists. For both of them were muffled in thick padded armor, especially at the throat, where its effect would be most painful, and at the same time they were exercising violently under intense excitement. Both dripped with perspiration and there were frequent calls for water. The Bavarian was ashy pale where the blood had not blurred out all view of his face, and it seemed at the close of every round that he must certainly drop, but he came up cheerfully at each cry of "Los," and went at the Tyrolean with vigor and sometimes with effect. The

swords flew with incredible swiftness, and the range of the duellists was by no means confined to each other. After one of the rounds we saw the Bavarian's second clap his hand to the back of his head, and when he took it away again out came the blood. It sometimes happens that the seconds are as seriously wounded as the duellists themselves. Indeed, a student may thus obtain a very conspicuous and honorable scar without having to go to the trouble and pain of a regular duel.

At last, at the end of fifteen rounds, the duellists were led back and their armor was loosened so that they could sit down. We were just congratulating ourselves that it was well over with, when we were informed that this was only the first half; there were fifteen rounds more to fight. The surgeons were very busy now for a time, and the fellow-corpsmen of each duellist crowded up to give him advice as to how he could best defend himself or overreach his opponent. The intermission lasted only a few minutes, and then, at the cry of the umpire, the men came back to their posts. Both walked steadily; it is a dishonor to waver or flinch. And then the hacking began again.

One of the oddest phases of the duel was the nonchalant attitude of the students who came as spectators. At no time was there a cheer, or a protest, or any other manifestation of enthusiasm or excitement,

although once there was general laughter over the retort of one of the seconds as to a charge of foul. Many of the students had brought their wooden beer mugs into the duelling-room with them, and they could be seen drinking from time to time, and even proposing in a loud voice the health of some one across the room. A bar-maid was continually pushing her way in and out among the crowd, sometimes at the very elbows of the seconds, and once we saw her coming into the room with a plate of sausage, cabbage, and rye bread. Some one had actually ordered lunch in this room of blood.

The closing fifteen rounds dragged themselves slowly along. They were even more bloody than the first. It was difficult to understand how the Bavarian stood it to the end, for nearly every round brought him a new wound or laid open an old one. Toward the end he began to pant with heat and exhaustion, and one of the surgeons examined his heart with some care; and evidently feeling that there was danger from this source, he wet a towel in cold water and placed it over the heart and just under the edge of the armor, and then the fighting went forward again with its usual vigor.

At the close of the duel, astonishing as it may seem, both contestants were able to walk upstairs to the dressing-room, although the Bavarian looked



A University Corps House

every moment as if he would go down. His appearance is not to be described in this place. An hour later we saw the Tyrolean walking about, unconcernedly smoking a cigarette, his colored cap perched on top of his bandages. He had not been seriously wounded, except for the single cut on top of his head. The Bavarian did not appear.

The duel had lasted in all about forty minutes. After it was over, we walked up the crooked road of the village between the quaint old houses. The air was sweet and fresh with spring and lilac blossoms, and the valley, which stretched out before us, lay green and peaceful in the sunshine. We saw the ancient brewery where the weak white beer that the students drink at their bouts is made; we caught the cool, sour smell as we passed the door. And it occurred to us now that it was all over, to inquire what was the cause of the bloody battle we had seen. Surely these men must have been mortal enemies; there must have been an unforgivable offence, possibly a romance behind it all. But never were we more mistaken. This was merely an arranged duel, we were informed. Of course there might have been an offence; it occasionally happened that there was really an offence. But this was a regular Saturday duel. The two men had been picked by the committee, matched according to their physical strength and condition, as well as by their past per-

formances, and a time had been set for them to fight. And they could not escape fighting without dishonor. A student who dons the colored cap of a corps, virtually offers a challenge to meet any comer with swords, and a student who does not join a corps must expect none of the glories and honors and consideration of the social side of a university career. He is nobody. The fighting goes on every Saturday in some of the little towns around the University, so many duels each week. The University actually provides and pays a teacher of swordsmanship, from whom the students learn the art of duelling, and then, by constant practising, they secure some degree of skill. And yet many duels are fought by new men who have had little or no practice, and it is merely a matter of standing up and taking a bloody slashing. We heard one student encouraging another who was to fight a duel. It was, "Come, go in and get some good scars"; it was not, "Go in and give the other man some good scars." Scars are curiously regarded by the German student. If they argue anything at all, they certainly argue a woful lack of skill at swordsmanship, for a really good swordsman should so defend himself that he would receive no wounds. Yet every scar is a badge of the greatest honor. Many duellists who are unfortunate in receiving all the wounds on the scalp where the hair covers them, go with close-cropped head so that their honor may

be apparent. The scar most prized is the long, deep cut across the cheek, just such a one as the Bavarian fighter had received in the duel which we had seen. We heard it whispered that sometimes a student came by his scars in roundabout ways, — little accidents with razors ; but one scarcely credits such a story, because it is much too simple a matter to obtain scars by the legitimate and highly honorable method of the duel. All this blood and slashing is accompanied by the most excruciating pain in healing, especially in cases where the cheek is cut through, and sometimes a student is compelled to wear bandages and a black cap, and eat porridge for weeks ; but he may comfort himself in his suffering with the assurance that there is no higher badge of honor than the black “duel hat.”

Is a duellist ever killed ?

In one of the corps houses of this University hangs a picture of a young student, with the point of a duelling sword framed near it. During the duel the sword had snapped, and the razor-like point had been driven into the duellist's heart. But a killing in a duel is comparatively rare. The greatest danger arises from blood-poisoning, the surgeons being only medical students, and often ill-equipped for dealing with such surgical cases. There have also been deaths from heart failure, due to over-exertion, heat, and loss of blood.

Duelling has now obtained such a hold on German student life that, although laws against it are in existence, little or no attempt is made to enforce them. There is an impression, born, perhaps, of the military spirit, that duelling produces strong and brave men. Formerly there was always a sentinel to report the coming of the police, and that formality is still observed in many cases, because it gives an added spice to the sport. If there is really an offence between the duellists, and occasionally there is, the fight may be with sabres and half-bare arms. This is considerably more serious than the sword duels, and it is understood that the police will try to prevent it. At the duels we saw, not the slightest precautions were taken in the way of sentinels, and any one who had an acquaintanceship among the students was perfectly at liberty to come in and see the battle. In fact, there were a number of spectators, evidently residents of the town, whose presence could have been explained only by the fact that they have been on hand at the time and had invested twenty pfennigs in a mug of the gasthof beer.

When we returned to our places at the beer table in the pavilion, the students were singing a rollicking student song and the surgeons were just coming in from their work on the poor Bavarian. We remained for one more duel, and then, although the performance continued until late in the afternoon, — that is,

all day long, — we had enough of it, and were glad to get away. The last we saw of our friend, the president of the Hanoverians, was on the stairway of the inn, his face gashed and indescribably bloody. He, too, had fought.

XII

THE NEW GERMANY, HER PROSPERITY
AND HER PROBLEMS

XII

THE NEW GERMANY

Her Prosperity and Her Problems

THE new Germany, as a whole, gives an observer the impression of tremendous activity and vitality, of change and improvement. One who visits the ancient town of Nuremberg looking only for the quaint evidences of mediæval grandeur and power will be astonished by the signs of present-day enterprise, — the smoking chimneys, the roaring street traffic, the busy shops, the brilliant lights.

Nuremberg is western and progressive — and yet not more so than the other great cities of Germany. Berlin has been growing more rapidly in the last decade than Chicago. In the twenty years from 1875 to 1895, the city more than doubled its population; while Hamburg gained 146 per cent., Munich 140 per cent., and Leipzig, famed once for its sleepy streets and ancient university, made the remarkable gain of 263 per cent. Expansion and prosperity are

everywhere; splendid new buildings and factories, new ships, new canals, new railroads. No man of the present age is more fully alive to his own powers, his interests, his weaknesses, than the German, and none is struggling harder to advance along all lines of human development. The Englishman has gone to sleep content with his own commercial supremacy and greatness; the American is not yet fully awake to his own power; the Frenchman frets himself with visions of a greatness that is gone; but the German is fully alive to every world-condition, establishing banks and business in South America, buying islands of Spain, boldly taking the lead in the Chinese troubles, extending his colonies in Africa, preparing to absorb Austria and possibly Asia Minor, building a splendid new navy, stretching the lines of his merchant marine around the world, and putting his manufactured products into the homes of every nation on earth. Germany has laid the foundation of her industries on the bed-rock of science and thorough technical education, to a degree equaled by no other nation. Thirty years ago coal-tar was almost unknown to German industry; between 1877 and 1890 no fewer than 800 patents were taken out on coal-tar derivatives, and in 1898 the industries connected with the utilization of coal-tar — a former waste material — yielded over \$17,000,000 in products. That is a sample of what the intelligent prac-

tical application of science has done. Fifty years ago the German was the world's typical dreamer, musician, poet, scholar; then he became the world's philosopher, scientist, and educator, and now he is appearing as a great man of affairs, of world politics, of giant industries.

Yet no other great nation in the world to-day is perplexed with such weighty and difficult problems, relating both to external and internal affairs, as Germany. No other great nation is torn by such diversities of opinion regarding economic and political questions, or presents such seemingly irreconcilable contrasts and changing relationships. In the cities, for instance, there exists a fierce socialistic and often revolutionary spirit, and opposed to this is the obstinate conservatism of the aristocratic Agrarians or land-owners (Yunkers), the latter demanding protection to agriculture with higher duties on imported food-stuffs, and the former, the wage-workers, demanding free trade and cheaper food. Between these two powerful opponents in the social and political scale, there lies seemingly a bottomless chasm, and it needs all the astuteness and power of the government, even with such a man as the young emperor at its head, to keep them together until Germany shall have developed a large and sensible middle class. Here also is the old German tendency to free thought and high culture set over against a government that will not

permit free speech, a free press, or free assemblage for the discussion of certain questions of administration and politics,— a government that punishes with an iron hand for “*lèse-majesté*.” Here is a vast and bloated militarism standing in contrast to a professed desire and a real need of peace, a huge army and navy costing millions in taxes and taking half a million men from agriculture and the industries, when there are not enough laborers to till the fields. Yet an army Germany must have, for jealous enemies crowd close on every side. The nation itself is hardly yet a nation; it is made up of many states, each more or less jealous of the others; the Catholics of the south distrust the Lutherans of the north, the Saxon dislikes the Prussian, and the Bavarian suspects both; then there are half-loyal Poles in East Germany, French in the Rhine country, Danes in Schleswig-Holstein. From all these diverse elements of population, loyalty, if it proceed not from desire, is demanded by force. It is a constant struggle between the centrifugal force exerted by twenty-five states, which only thirty years ago were separate sovereignties, and the centripetal force of the powerful Prussian monarchy, with an iron-handed Hohenzollern at its head. More than one prophet during the past thirty years, who has seen all these dark problems, has predicted the speedy downfall of German political institutions; yet Germany still

stands, a great and powerful nation, and one cannot but feel that the sober and practical sense of the German citizen, combined with an intelligent and powerful administration, will ultimately prevail, and that Germany will continue to go forward and upward.

THE END

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